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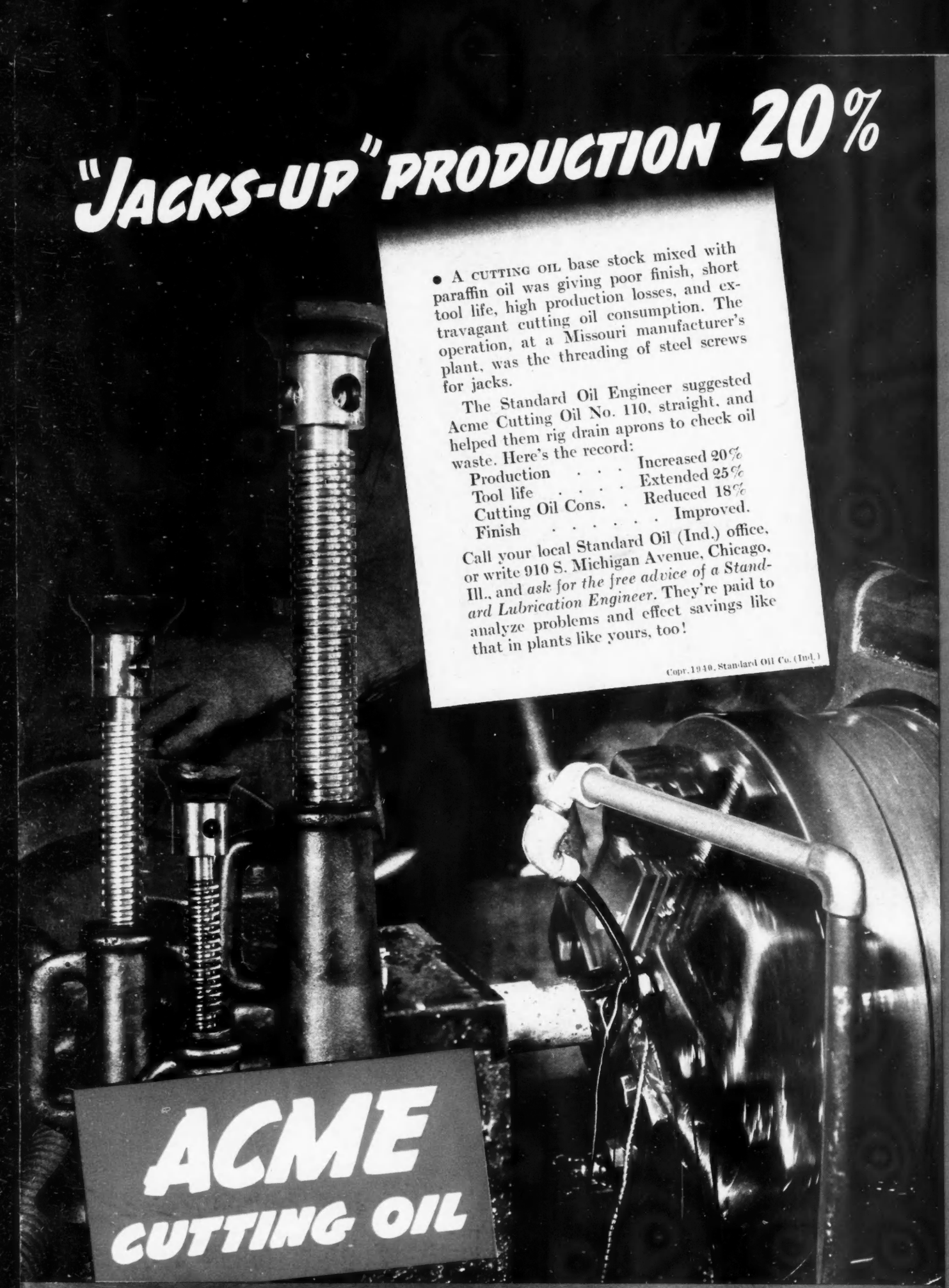

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 82 Number 9

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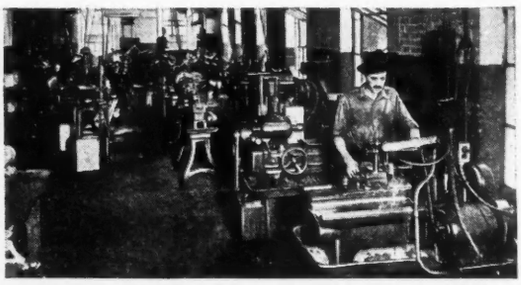
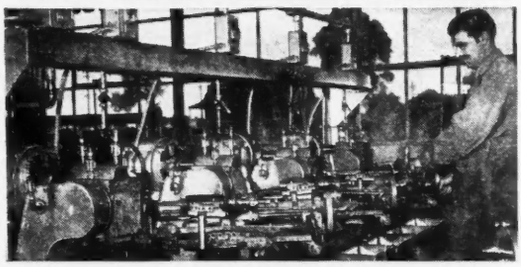
300% SAVING IN SOLUBLE OILS

. . . screw machine department of southern textile machinery builder where this result was achieved.



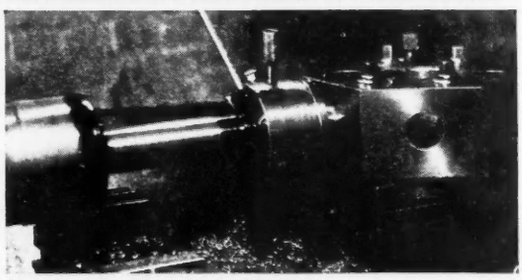
COSTS REDUCED

. . . battery of special machines where manufacturing costs were cut by using *Texaco Sultex Cutting Oil.*



CHASER LIFE TRIPLED

. . . geometric diehead cutting triple threads in welded steel tubing with this big money-saving result.

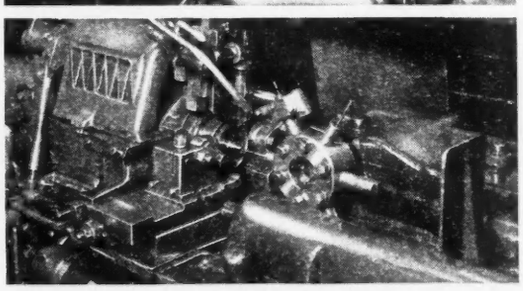


TAP LIFE BOOSTED 150%

. . . in tapping blind holes in thin-walled nickel-iron, output was jumped from 2400 to 6000 pieces per tap.

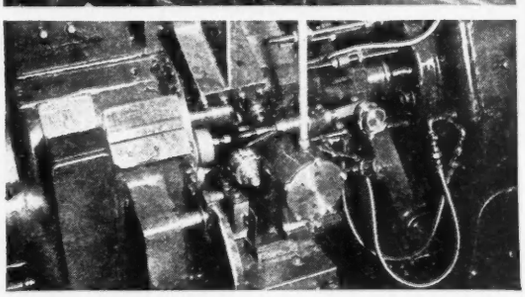
BETTER FINISH

. . . pivot stud job on B & S Automatics showed outstanding improvement in finish with *Texaco Sultex Cutting Oil.*



LONGER TOOL LIFE

. . . on this 6-spindle Acme-Gridley, *Texaco Sultex Cutting Oil* substantially lengthened time between dressings.



BETTER RESULTS

. . THAN THEY EVER THOUGHT POSSIBLE!

YES, we believe that you, too, will better the results you're getting—by turning at once to *Texaco Sultex Cutting & Soluble Oils.* Certainly, it will be worthwhile to at least find out for yourself! Let a Texaco Engineer demonstrate the savings you will get by using *Texaco Sultex Cutting & Soluble Oils.* Phone the nearest of over 2300 warehouses, or write to:

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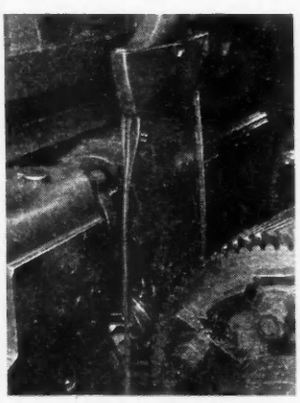
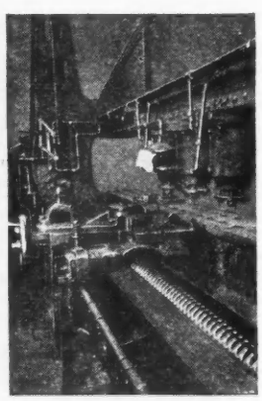
TEXACO



LESS LAPPING

. . . these pinions Brinell at 300 to 370. With *Texaco Transultex Cutting Oil* they came out in a smoother finish.



OUTPUT DOUBLED

. . . heavier cuts and increased speed were the immediate results on this plate planer after these people turned to Texaco.

TEXACO SULTEX

CUTTING AND SOLUBLE OILS

IN THIS ISSUE . . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 82 May 1, 1940 Number 9

AMERICAN trucks are now in service with the French army. The first to go into operation were Studebakers, followed by White, Dodge and G.M.C. While practically standard models, equipment comprises external gas tank, closed driver's cab, rectangular radiator guard, a separate guard in front of each headlight, a platform body with detachable canvas top and oversize dual tires. One of the G.M. shops in France is unboxing and assembling 5000 American motorcycles, most of them with sidecars.

The arrival of American trucks in France doubtless will relieve the civil transport situation, which is reported to be far from satisfactory. Since the end of August new vehicle registrations have been very low, varying from 4000 to 6000 per month, compared with 12,000 to 18,000 a year ago. These official figures comprise both passenger cars and trucks. There are no stocks of used trucks and manufacturers and importers of new trucks of more than 3000 lb. load capacity are not allowed to sell to civilians without a special permit. High powered used passenger cars are available, but sales are sluggish by reason of gasoline restrictions. Prices of small cars, both new and used, are soaring. Every week the army turns over a number of trucks for sale by auction, but nearly all of these are in need of more or less extensive repairs and skilled labor is difficult to obtain.

Railroads, which for a number of years have very successfully fought trucking interests, now refuse to carry freight for distances of less than 15 miles.

Numbers of German planes are fitted with gasoline injection in place of a carburetor. This has raised the cry in Allied circles that the injector must have advantages over the carburetor, or it would not be used by the German air force, and in certain circles it is maintained that the French and English ought to switch to injectors. There is every reason to believe that technical considerations did not dictate Germany's choice. Six years ago the Bosch Company, of Stuttgart, made it known that it was about to

(*Turn to page* 442, *please*)

GENERAL

Page

Eastman Report Shows Automotive Taxes Diverted 401

After a lot of investigating, reviewing and analyzing the Eastman Report has been completed. The money that has emanated from the automotive field supposedly for the roadways of the country but has found its way to other ports mounts to surprising figures. Riley Eglen gives the figures as they are reported and further points out just how much they mean to the automotive industry. It is a thorough treatise and enlightening reading.

PRODUCTION

Two Million Carburetors a Year 404

There are some most unusual production methods and equipment at the plant of the Carter Carburetor Corp. In this, the forty-eighth of the monthly production features, Joseph Geschelin brings it right to you with his usual thoroughness.

TESTING

Twenty Years of Tractor Tests 414

For twenty years the Nebraska State College has been testing tractors. They have developed the technique of these tests to a high degree. In that state, through an act of the legislature, their tests must be passed while in practically all of the other states manufacturers and users alike accept their finding as standard. In this article P. M. Heldt has developed an interesting account of their methods and the background that has developed the present routine.

Business in Brief 403

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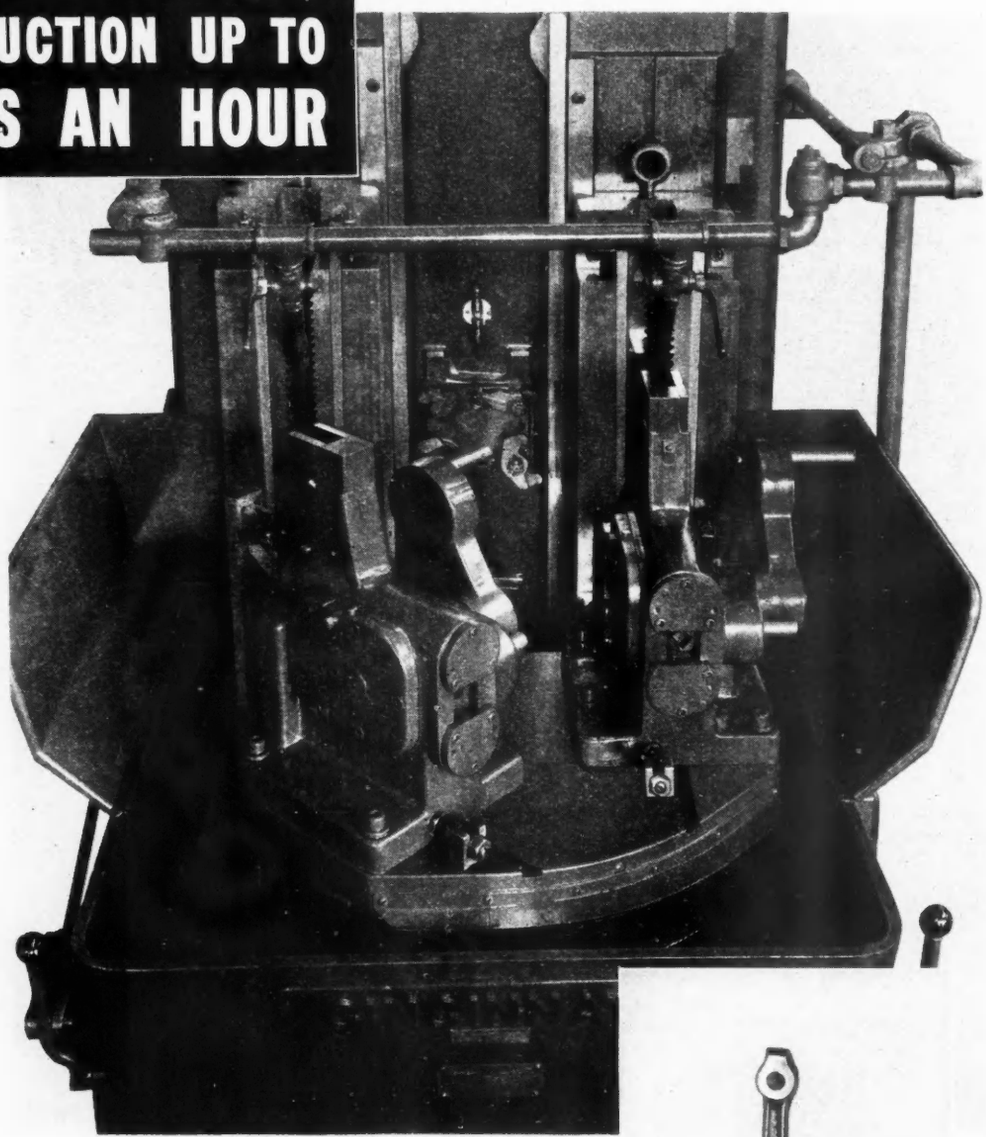
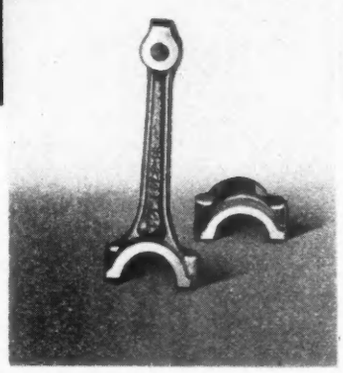
Since 1913 all issues of AUTOMOTIVE INDUSTRIES have been indexed in the *Industrial Arts Index*, which can be consulted in any public library.

BROACHING THEM IN PAIRS STEPS PRODUCTION UP TO 548 PARTS AN HOUR





THE crank cheek faces of connecting rods and caps may be finished in several ways, but there's only one best method for low cost, high production, and accuracy. The CINCINNATI Broaching equipment illustrated here fulfills all these requirements.

Each fixture holds two parts—one rod and one cap—one above the other. A swing of the weighted lever clamps both parts simultaneously. With the CINCINNATI Duplex Hydro-Broach Machine, and fixtures like these, *the operator easily turns out 548 parts an hour.*

The exclusive CINCINNATI swivel table design, common to all CINCINNATI Duplex Hydro-Broach Machines, eliminates non-productive time ordinarily required for handling the work. This feature is important in stepping up your production and lowering your costs. Investigate today by writing for circular M-842.

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Manufacturers of

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AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 82, No. 9
May 1, 1940

Eastman Report Shows Motor Taxes Diverted

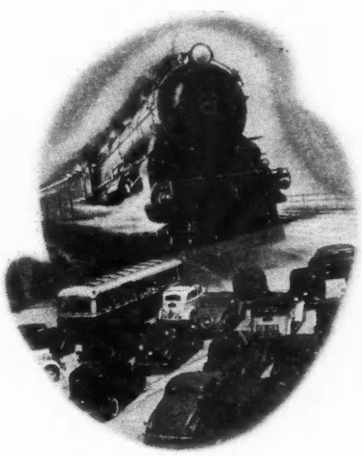
to uses other than road projects and upkeep. From 1933 to 1937 diversions totalled $283,895,000

By RILEY ELGEN

THE age-old argument concerning what form of transportation has been subsidized the most may now be settled. Interstate Commerce Commission Chairman Joseph B. Eastman at long last has published his four-inch library in four volumes concerning Public Aids to Transportation by air, rail, water and motor.

The report shows that the rails have been aided most by the public. This public assistance, he says, amounted to $1,443,000,000. On the other hand, it shows that for all practical purposes it may be definitely stated that motor vehicle users as a class have more than paid their way[1] since 1927. This disposes of another wonderful brain child of those who for reasons of their own would hamper yours and my use of the highways through the imposition of prohibitive taxation through the "public utility" theory of public roads[1].

No one will find fault with Mr. Eastman's statement that it is both logical and appropriate that the costs incurred in the construction and maintenance of highways should be a direct charge on the users instead of a burden on general taxation. And computations made from the essential fundamental facts from time to time by the writer have demonstrated that such burdens are being more than borne by those who use the highways. In fact, it is pointed out by Mr. Eastman, that many hundreds of millions of dollars collected from highway users expressly for the construction and upkeep of the public roads find their way to other uses of government departments not in any way related with road work. Obviously there would be no sense in diverting such funds to uses other than highway purposes unless they were obtained in excess of the highway needs.



It is doubtful whether or not arguments between different forms of public transportation as to the extent each has been subsidized or furnished public assistance ought to be given greater dignity than any other jealousies arising from time to time between competitors. It is quite apparent from the Eastman Report that public authorities ever since the advent of rail transportation have sought through aids, donations, and grants to encourage its expansion into all sections of the country. Long before railroads, in fact beginning with the time the Jefferson Administration started the

The Eastman Report states . . . .

"The introduction of more efficient or economical means of transportation ought not to be prevented to save existing carriers from injury, for otherwise progress would be stopped"

[1] The writer has long contended that, in fact, motor vehicles are more than paying the highway bill. See article published by National Conference of Highway Users, April, 1939.

GENERAL

old Cumberland Road from Baltimore toward the Ohio, the Government of the United States and separately the several states have gone to the greatest possible limits to give public aid to any well-conceived project that promised to furnish more and better public means of communication with parts of the nation not thus adequately served.

After the old Cumberland Road there were innumerable canal projects fostered, aided, or built by public action throughout the country east of the Ohio, including the notable Erie Canal project. Then came the rail lines, and since that time nothing was too much for national, state and local governments to do to encourage and aid the construction and operation of them. The Eastman Report summarized these public aids to railroads up to and including 1936, the total found was stated as $1,443,000,000. My own studies of the same sources of data and other data not mentioned leads me to conclude that the value of the public aids to the railroads totaled not less than $2,000,000,000. After studying this subject for a quarter of a century I agree with Mr. Eastman that there is plenty of "room for bona fide differences of opinion" concerning the interpretation of the values of many of these public aids. I think Dr. Morgan, a most competent and capable person, under whose guidance the Eastman Report was made, leaned backward to be just and reasonable and to attribute the most conservative value to the innumerable public aids found.

The value of some of these public aids can hardly be measured by the cost of the government service rendered at the time or of the government bonds lent, guaranteed, or exchanged for securities of the aided railroads. Like the successful man whose future was assured because of funds furnished by someone who had confidence in him, the value of that service was far in excess of the outlay which enabled him to acquire the education through which to attain his ultimate success. Mr. Eastman's Report states that but for that public aid untold thousands of miles of rail lines would never have been built until many decades later than they were constructed. That would have been bad for the rails and bad for our nation.

A study of the details of the Eastman Report on Public Aid to Transportation (Vol. II) discloses that almost, if not all, of our now nationally known rail systems, speaking alphabetically, from the Atchison to the Western Maryland, received valuable public aid when they needed it most. That is when they were trying to get a start in life. These conclusions are not at variance with the Eastman Report when Mr. Eastman says—

> "While it now seems comparatively small in comparison with the size of the industry, it was of much greater relative magnitude at the time when it was extended."

He also recognized that only through these public aids was it possible for rail lines to get started when they did. That thought is reflected in the early attempts of private corporations as shown in the Eastman Report to get the Pennsylvania Railroad under construction. Finally these private attempts were abandoned and the State of Pennsylvania through its construction of its Main Line of Public Works from Philadelphia to Pittsburgh got what is now the Pennsylvania Railroad under operation. Then these Works were transferred to the present Pennsylvania Railroad and subsequently formed the backbone of that system.

Similarly his report shows that the City of Baltimore and the State of Maryland used the public credit to get the first American railroad, the present Baltimore and Ohio System, started. And during its most successful period of operation from 1828 to 1894 the City and State had a majority on the Baltimore and Ohio Board of Directors. To the North the Report shows the State of New York and its counties and municipalities assisted in getting the New York Central under way. And to the South the State of Virginia and its counties and municipalities have always been most

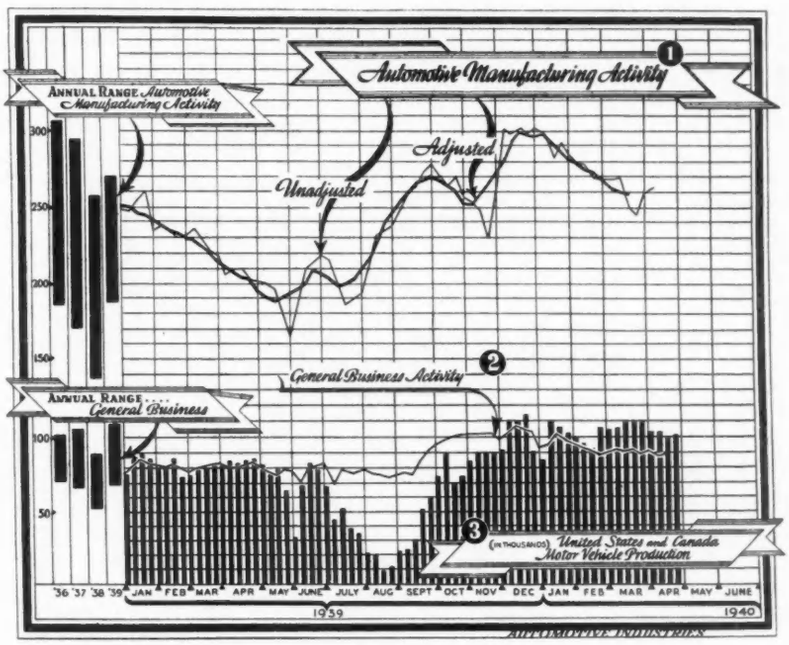
(Turn to page 426)

The Brass-Hat Rack

"No matter what it does to sales, it's going to be hard on petting parties!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

First Three Months Top '39 Period

PRODUCTION of motor cars and trucks tapered off slightly during April as manufacturers endeavored to bring dealer stocks in line with current demand. Nevertheless, aided by 22 working days, one more than either February or March, April output was estimated at 450,000 units, approximating January's total of 449,314 vehicles. Output for the week ending April 20 was about 100,000 units, while the succeeding week was likely to show a slight rise, according to preliminary estimates.

April production ran almost 100,000 units ahead of April, 1939, when 354,263 units were turned out, and was somewhat higher than March's official figure of 439,911 vehicles.

General Motors production was back over the 45,000 mark for the week ending April 20, reflecting the record first quarter sales of that corporation. Chrysler divisions turned out 23,000 units, while Ford, reverting to a four-day week, accounted for 18,000 vehicles. Studebaker headed the independents, followed by Hudson, Packard, Nash, Willys and Graham.

Production figures for the first four months of 1940 were estimated at 1,760,000 vehicles for the United States and Canada, 24 per cent ahead of the corresponding period of 1939. Sales for the first three months of the year were estimated at 967,816 units by the Automobile Manufacturers Association, which is a gain of 29 per cent over the first quarter of 1939. This indicates that sales are more than keeping pace with the production increase despite a late spring in the northern and eastern states.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

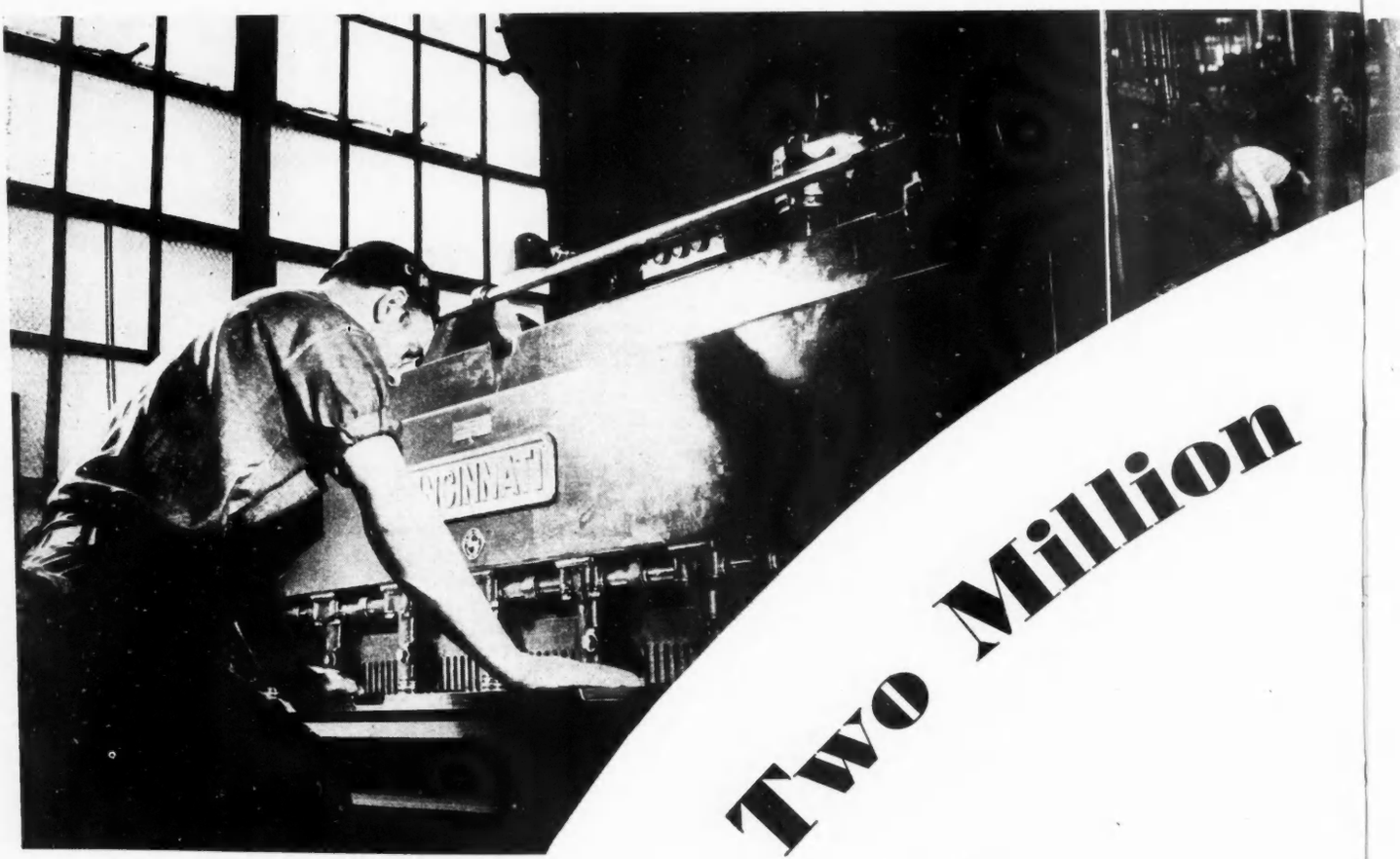
Early April sales reports showed that month continuing the upward trend evident in the preceding three months. March retail sales of 398,365 motor cars and trucks were 20.4 per cent ahead of March, 1939, by A. M. A. estimate, with the peak months of April and May in the spring selling season still ahead.

Paced by Chevrolet, which already has produced 700,000 of the 1940 models, General Motors reported first quarter sales of 419,308 vehicles in the United States during the first quarter, 30 per cent ahead of 1939. Sales reports for the first 10 days of April for General Motors divisions ran 22 to 52 per cent ahead of that period in 1939, Chevrolet showing a gain of 51 per cent.

Ford motor car and truck and Mercury retail deliveries were 216,935 units for the first quarter of 1940, 26 per cent above the 1939 figure. Chrysler experienced a record first quarter with retail sales of 344,759 units, bettering the 1937 first quarter record of 283,571 units. The 1940 first quarter was 28 per cent better than the first three months of 1939. Studebaker's first quarter retail deliveries of 22,389 motor cars and trucks were 87 per cent above the 1939 period. Hudson and Nash also reported sizable increases in sales.

Used cars were reported moving well, no companies reporting more than a 35-day supply on hand.

AUTOMOTIVE MANUFACTURING ACTIVITY began to pick up in the weeks ended April 6 and April 13, registering unadjusted index levels of 259 and 263, respectively. The adjusted index curve charted herewith passed through the points 260 and 259 during the weeks ended March 16 and March 23.



Two Million

A new item of equipment is this Cincinnati precision square shear with hydraulic hold-downs.

This is the Forty-eighth in the series of monthly production features

(Left) A corner of the press shop, showing part of the many punch press operations required in carburetor fabrication.

(Right) Close-up of one of Kingsbury automatic multiple-head drilling machines recently installed. The layout and positioning of the heads are explained in Plate 1.

(Extreme Right) Interesting detail is linking of a pair of No. 2 Brown & Sharpe automatics for the first and second operations on needle seats made from hex brass bar stock. Work from the first operation machine, at the left, is transported to the work station of the second machine through the tubular chute, propelled by air pressure.

Carburetors a Year

are produced in the Carter plant where flexibility culminates in a bank of huge multiple-spindle drilling machines that are fully automatic and interchangeable

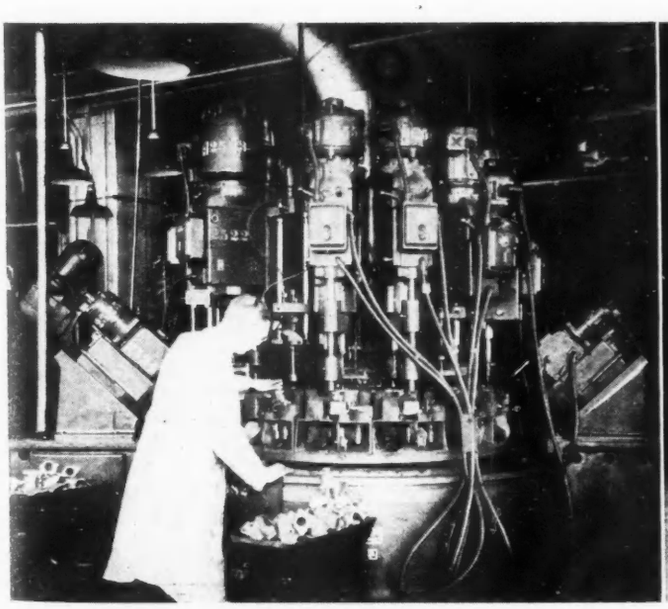
By JOSEPH GESCHELIN

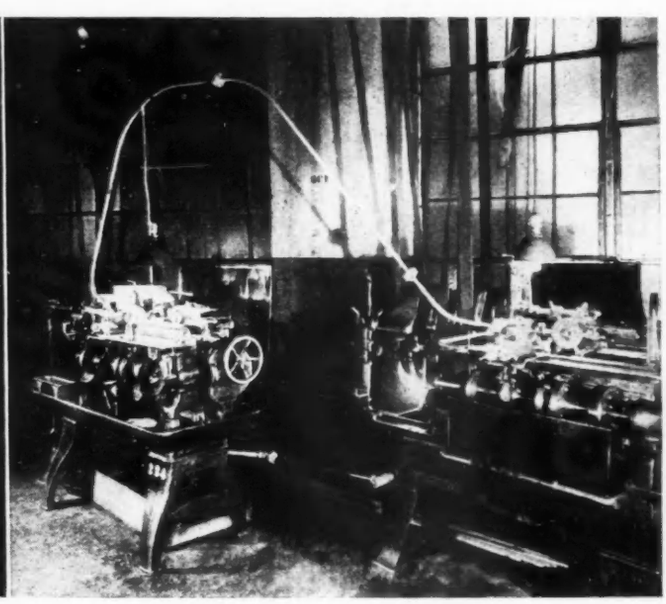
NO MATTER where you may be—in Tokyo, Coimbatore, Honolulu, Oslo, Paris, Brussels, or Buenos Aires—you will find at least one man who is a graduate of factory service school of Carter Carburetor Corp. and, consequently, a competent man on carburetor repairs and engine tune-up. The school has available a budget of $50,000 a year for this purpose.

This activity is tangible evidence of a firm adherence to the original principle on which the company was founded, namely, that of concentrating on the development and manufacture of just one product. How well this goal has been attained may be judged from the fact that something over 14 million Carter Carburetors have been produced in the last seven years.

Surprisingly, even this rigid specialization does not connote a simplification of their production scheduling problems. As a matter of fact, Carter has on schedule at the moment a total of 84 different models for current production, built over 200 different variations in 1939. Some idea of the volume of raw materials employed in this enterprise may be gained from the fact that last year it consumed a total of 4,214,399 lb. of high purity zinc alloy alone.

In common with other progressive parts makers, Carter carries on an uninterrupted program of research and modernization both of product and fabrication techniques and has completed some rather extensive additions and plant changes. Outstanding feature of this activity is found in a battery of eight marvelous automatic multiple-head drilling machines, tooled to produce the intricately drilled and bored passages in carburetor bodies and flanges.





PRODUCTION

One of the long carburetor lines, in perpective, showing detail of individual assembly stations. These lines have from 27 to 52 separate stations depending upon the complexity of the assembly.

The enterprise began in 1909 as The Carter Carburetor Co., pioneered an air valve, multiple-jet carburetor known as the Model "C." Hugh H. C. Weed, present vice-president and general manager, started as vice-president of the original company in 1913, has piloted its course through the many vicissitudes of business cycles right through to the present day. During the historical depression of 1920-21 when all of its standard equipment accounts, save one, went into bankruptcy, Carter was forced to follow suit late in 1921. Yet during that critical period, Mr. Weed demonstrated his faith in the product and continued to carry the key men with funds borrowed and guaranteed by his personal assets.

Early in 1922 the assets of the company were acquired by the American Car & Foundry Co., resuming operations at the A.C.F. carburetor division up to 1925 when the company was incorporated under the present name—Carter Carburetor Corp.

During this interval progress was made by concentrating on the production of 1-in. units exclusively, followed later by a unique inter-connected choke and throttle to provide fast idle. The first Carter downdraft carburetor was placed on the market in 1929, the first triple-venturi in 1930. In 1934, Hudson adopted the first Carter integral automatic choke carburetor. The 1-in. dual downdraft model was developed in 1935, now is standard equipment on Buick, Olds, Pontiac, LaSalle, Cadillac, Nash, Hudson, and others.

Today the company serves every corner of the industry. The plant has been expanded to include a total of practically 200,000 sq. ft., of which 110,383 sq. ft. is actual production floor space.

The line of products currently listed comprises the following items:

Manual choke carburetors.

Automatic choke carburetors.

Fuel filters.

Constant level valves.

Mixing valves for single-cylinder engines.

It is almost trite to say that the modern carburetor is a highly intricate instrument made with exceedingly fine tolerances, emphasizing quality controls that brook no deviation from the standard. At Carter, the organization is composed of some 1500-1600 employes and it is astounding to find that there is an inspector for every three production workers.

To an observer of management principles, the finest aspect of the operation is the management's employe relations policy. Beyond a doubt, its sincerity and practicability have much to do with the *esprit de corps* of the organization. All production workers are on a wage incentive basis with group piece work operation wherever expedient. It is noteworthy that there is an adjustment of group size and group composition so as to yield the best earnings.

Monthly salaried employes are placed on an incentive system after 90 days of service, on the following basis:

(a) Bonus payable monthly so that the results of good team work are felt promptly.

(b) Each employe is paid a bonus on the accomplishments of his whole division so that it is financially to his interest to cooperate with other employes.

(c) Bonuses are based on salary so that an increase in salary automatically increases bonus.

Nor are the problems of regularization of employment neglected. To a large extent, an effort is made to so schedule production as to run the after-market requirements into periods of slackness in standard equipment orders. During seasonal slack periods when

List of Factory Executive Personnel

Hugh H. C. Weed	Vice President and General Manager
M. F. Peterson	Assistant to General Manager
W. M. Ewart	Factory Manager
E. H. Nieman	Superintendent
W. L. Slingman	Chief Inspector
J. H. Klasey	Plant Engineer
A. A. Krome	Local Supply Agent (Purchasing Department)
A. E. Connole	Manager Personnel Department
W. Walz	Master Mechanic
Lydia V. Dunne	Superintendent of Nurses
B. H. Gerker	Production Engineer

even this device is not sufficient to keep the wheels turning, lighter equipment schedules are partly offset by building up service inventories to an extent dictated by past experience and future potential.

Another vital element in the human equation of this business is the striking fact that every possibility of an occupational hazard either in equipment or process has been fully explored and reduced to a minimum.

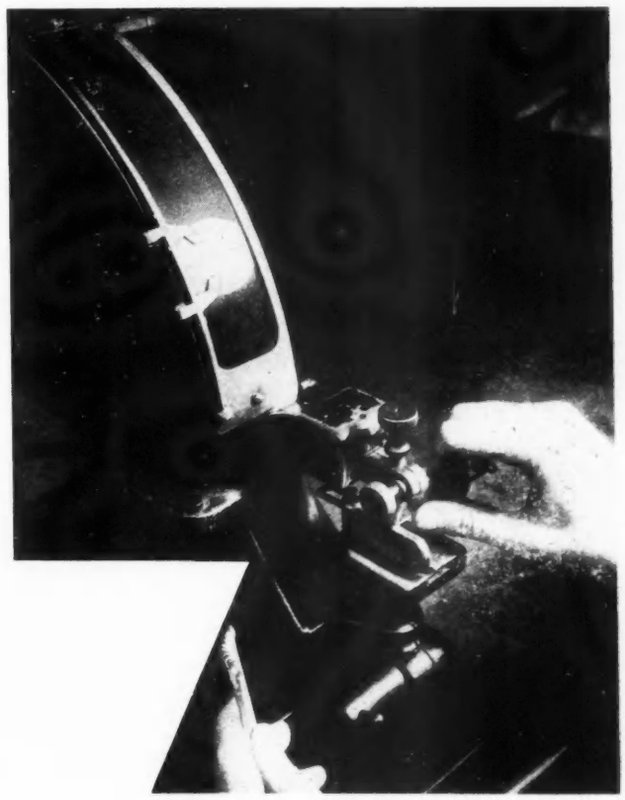
Coming to the details of the production division, we find that its activity has been logically divided into the following departments:

Plant Engineering
Inspection
Shipping and Receiving
Die Casting
Jets
Machine Shop
Assembly
Automatic Screw Machine
Maintenance
Tool Room

Due to the use of cast iron and zinc alloy die castings for bodies and flanges, it will be noted that there are separate departments for each type of metal. Cast iron bodies and flanges are machined on the first floor, providing an unusual contrast between the new methods of handling mass production parts and the conventional equipment for multiple-lot production.

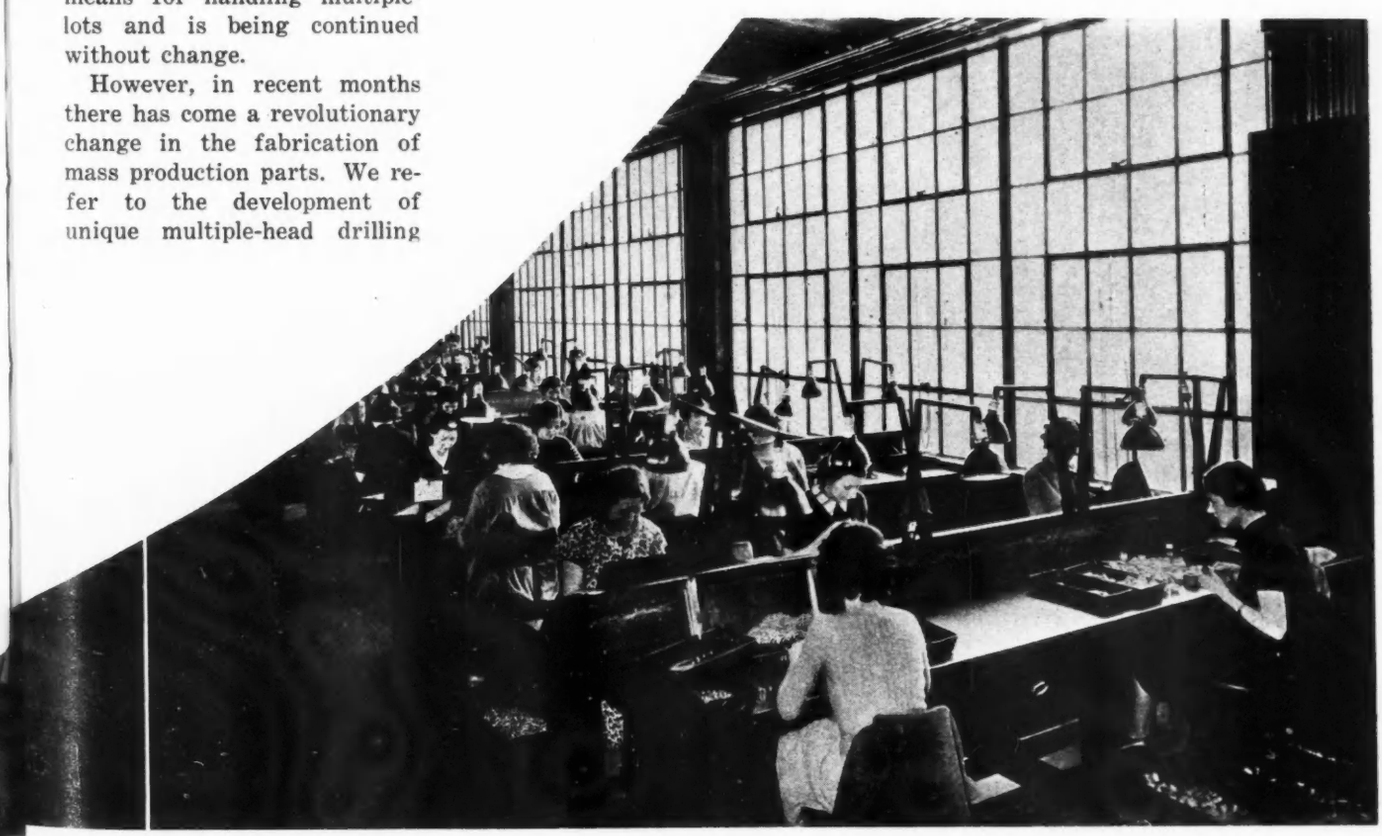
Throughout the machine shops, the standard equipment consists of lines of Avey four-spindle drill presses for drilling, tapping, boring, etc., fitted with high-speed heads and other special attachments warranted by individual operations. This type of equipment still remains the most economical and most flexible means for handling multiple-lots and is being continued without change.

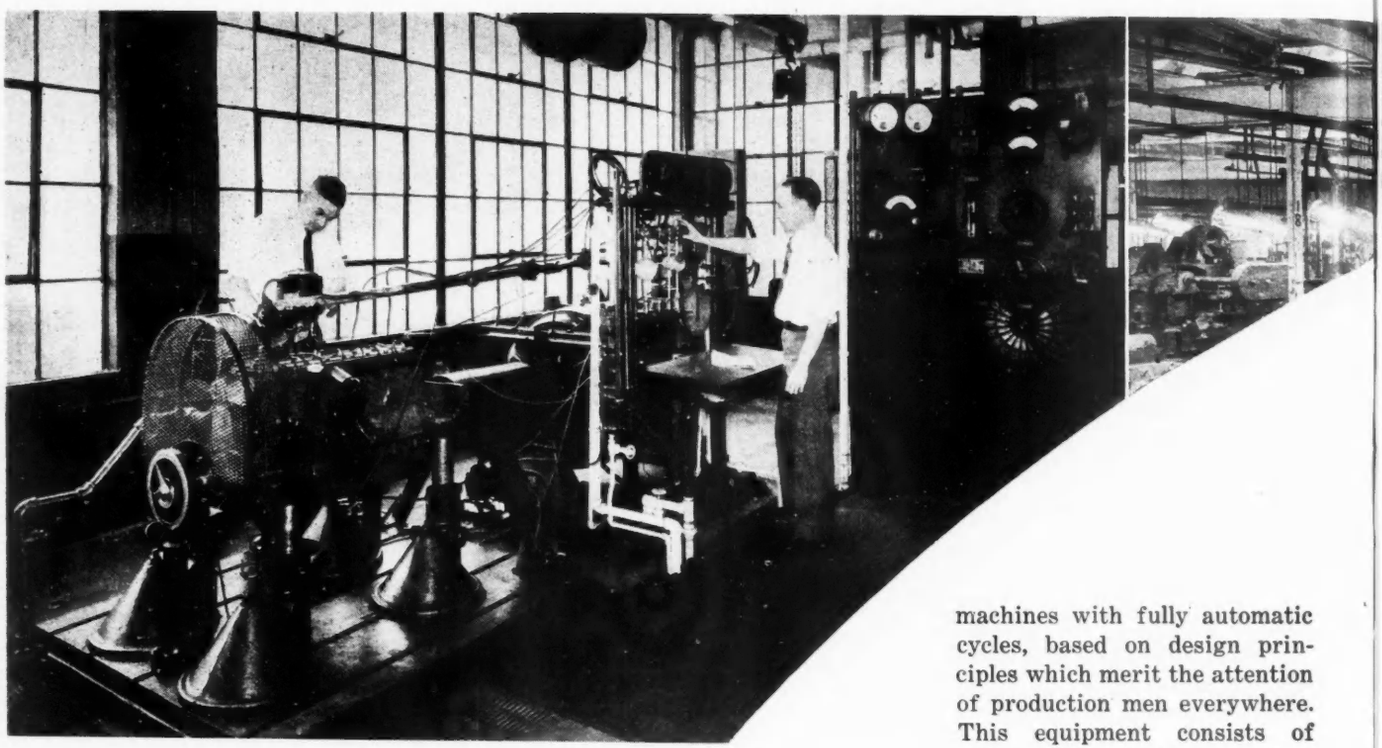
However, in recent months there has come a revolutionary change in the fabrication of mass production parts. We refer to the development of unique multiple-head drilling



(Above) Close-up of visual light gage with 1000 to 1 amplification used for checking dimensions of metering rods.

(Below) Quality control is basic at Carter. This shows one of the batteries of inspection benches located in various departments.





(Above) A corner of the research department showing the character of dynamometer test equipment for carburetor investigations.

machines with fully automatic cycles, based on design principles which merit the attention of production men everywhere. This equipment consists of eight huge machines — four built by Kingsbury, four by Avey — according to Carter specifications, every element of each of the machines being fully interchangeable with those of every other machine. In our experience this represents the fullest development of flexibility toward which progressive parts makers have been pointing in recent years.

High production cast iron bodies are completely finished, in all of their intricacy of drilling, tapping, boring, etc., on a battery of four of these automatic machines. The arrangement and sequence of operations may be conveniently followed in the factory routing reproduced elsewhere in the article. Incidentally, the contrast between mass production and multiple-lot procedures is supplied by the routing of a standard part on the four-spindle drill press line.

Carter's plant engineering department has developed an ingenious scheme for keeping track of the current set-up of tooling and heads on each of the new machines by a system of standardized symbols for unit head positioning. This is expressed graphically in Plate 1 which shows the arrangement and number of heads on each of the four machines noted in the cast iron body routing. The same principle applies to the other four machines. It will be noted that each machine table has been laid out symmetrically for 14 stations, regardless of the number actually employed. The No. 1 station is generally used for the

(Below) One of a battery of Pratt & Whitney jig borers found in the tool room.

(Right) View of one of the two large Bonderizing machines recently installed here. One is used for coating zinc die castings; the other for cast iron parts.

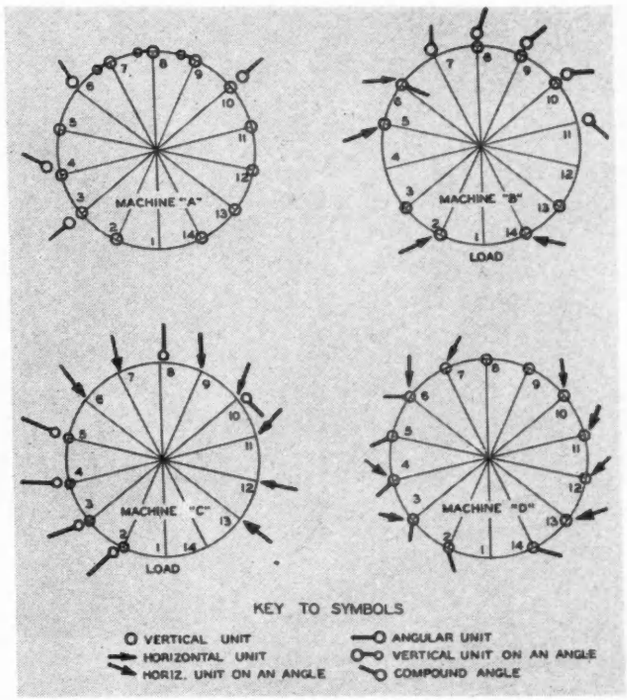
(Extreme Right) Important addition in the tool room is the latest edition of the Kearney & Trecker vertical mill, with a close-up of the work station.

loading position. Being completely interchangeable, it is possible to make a rapid changeover of head positions in the event of product changes, simply by the use of special wedge blocks or attachments. But the design principle goes even beyond this. By proper consideration of the requirements of various parts, the machines are tooled, at any given time, so as to handle a variety of similar parts without any change in head positions.

For example, the four machines for flanges are arranged in pairs so that one pair takes care of all the operations, save for several odd holes which are handled in conventional drill presses. As set up at the moment, one of the batteries is tooled to take care of no less than nine different flanges.

Another unmistakable touch of modernity is the adoption of surface broaching to replace milling in the finishing of body flanges. As indicated on the routing, they have installed one of the big Cincinnati 5-48 Duplex vertical hydraulic surface broaching machines, adjusted for a ram cutting speed of 42 ft. per min., removing about 0.10 in. of metal from each side. This straddle broaching operation produces surfaces flat within 0.002 in., both faces being broached simultaneously. The bodies are automatically clamped in the fixtures, of which there are two, each accommodating one part.

Following the machine shop operations in various departments on the first floor, the cast iron parts go to a new Bonderizing machine for corrosion-resisting treatment. A similar piece of equipment will be found

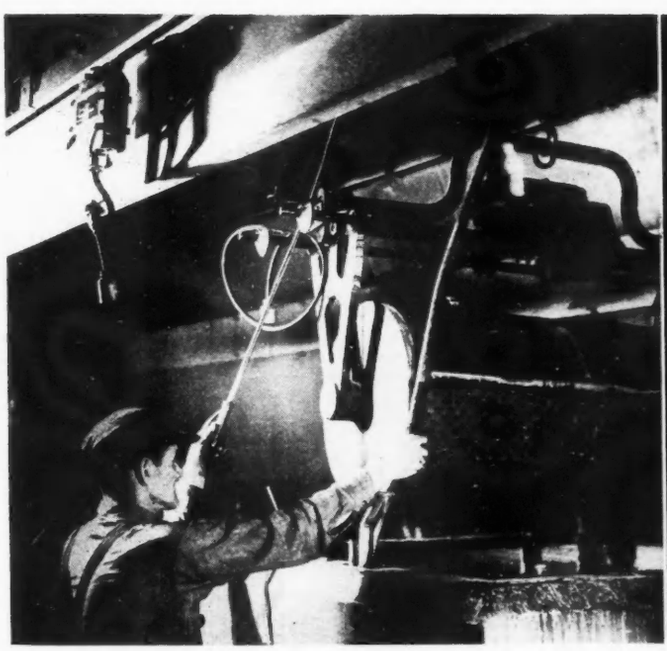


Kingsbury multiple-head machine layout for each of the four automatic drilling machines set-up for producing carburetor bodies. The schematic layout indicates head location and type of head for each station, as explained in the text.

on the third floor for surface coating the zinc alloy die castings which are processed there.

On the first floor, too, will be found the automatic screw machine department serving the entire establishment. It includes a main battery of the familiar Brown & Sharpe automatics, a smaller battery of Davenport automatics. In 1939, the screw machine department made over 63 million parts.

Some of the tooling in this department is really



(Above) Close-up of one of the many die casting machines found in the die casting department. They use high-purity zinc alloy, exclusively.

fascinating. Here, for example, are two pairs of No. 2 Brown & Sharpe automatics, each pair producing needle seats fabricated from hexagonal brass bars. First operation details are performed on one machine, the work automatically ejected into a long delivery tube connecting the work-stations of both machines. The parts are picked off at the second machine, chucked automatically, then finished. Due to the comparatively great length of the magazine tube, movement of the small parts is expedited by air pressure. Details of this arrangement, as well as of the air delivery connection, will be noted in the illustration.

Another interesting job is the monel metal gasoline intake needle, formed and cut off on a No. 0 Brown & Sharpe automatic, finish-formed and pointed at an exceptionally fast rate on a No. 00 B. & S. automatic. This is thought to be one of the very first examples of needle pointing in an automatic.

Unusual is the No. 0 B. & S. automatic set-up for producing the ball check plug and ball assembly. The entire piece is fully formed and finished in one setting, fitted with the ball, then the ball crimped in place without removing from the machine.

Activity on the second floor is almost exclusively that of sub-assembly, final carburetor assembly, inspection, and flow testing. Carburetor assembly is scheduled on three long double lines fitted with special work stations, conveyor equipment, etc. An assembly line will consist of from 27 to 52 individual stations, not including sub-assembly which is done at stations remote from the main assembly lines. The plant engineering department is at present experimenting with shorter, more compact lines, in an effort to break up assembly operations into smaller groups.

Apart from the minute control of quality at every step, the finished units are checked visually, then are sent on to the flow department. All rejects in the flow test are returned to assembly where they are routed to repair benches which are a part of the assembly group.

(Below) The behavior of full-sized passenger cars and power plants under sub-zero conditions is investigated in this modern cold room.

All carburetors must pass muster in the flow department, one corner of which is shown here.

The flow test department is a fine example of invariable scientific control provided with all manner of suitable test equipment—for flow testing the jets, a carburetor gasoline stand for testing pump action, flow stands for measuring fuel flow within 3 per cent with respect to a standard sample.

Operators on the carburetor flow stands check each instrument for three to five positions of the throttle. Due to the controlling effect of atmospheric conditions on the adjustment of flow test equipment, each device is checked against a master instrument, the calibration being made each morning before starting work, and four times or more per day, depending upon weather conditions. To assure the proper functioning of flow equipment, the source of power is a 400-hp. bank of vacuum pumps.

Finally approved instruments leave this department directly for packing and shipping.

The third floor houses the production tool room, employing upwards of 100 tool makers, the jet department, die casting equipment, die cast machining.

The tool room is exceptionally well equipped with modern machinery including—three Pratt & Whitney jig borers, one Keller full automatic tool room machine, a new Model D Kearney & Trecker rotary head tool and die milling machine, and others. There is a separate tool room for the experimental department, employing 14 men.

Factory Routing for Cast Iron Carburetor Body

SNAG ON GRINDER
ROUGH REAM venturi on drill press
BROACH two ends on Cincinnati vertical hydraulic broaching machine

Kingsbury "A" Machine

STATION (1) load. **STATION (2)** rough throttle bore part way and bore venturi throat. **STATION (3)** drill No. 30 pump passage part way. Finish rough bore throttle, venturi taper and throat. **STATION (4)** drill No. 4 and spotface metering passage. (jet to nozzle). Stamp identification number. **STATION (5)** semi-finish bore throttle bore, venturi taper and throat. **STATION (6)** finish drill No. 4 metering passage (jet to nozzle). **STATION (7)** drill No. 4 low speed jet hole. **STATION (8)** drill No. 33 low speed jet hole. **STATION (9)** counterbore low speed jet hole. **STATION (10)** finish drill No. 30 pump passage. First ream throttle bore. **STATION (11)** step drill ball check part way. **STATION (12)** finish ream throttle bore. **STATION (13)** drill two flange holes. **STATION (14)** ream two flange holes.

Kingsbury "B" Machine

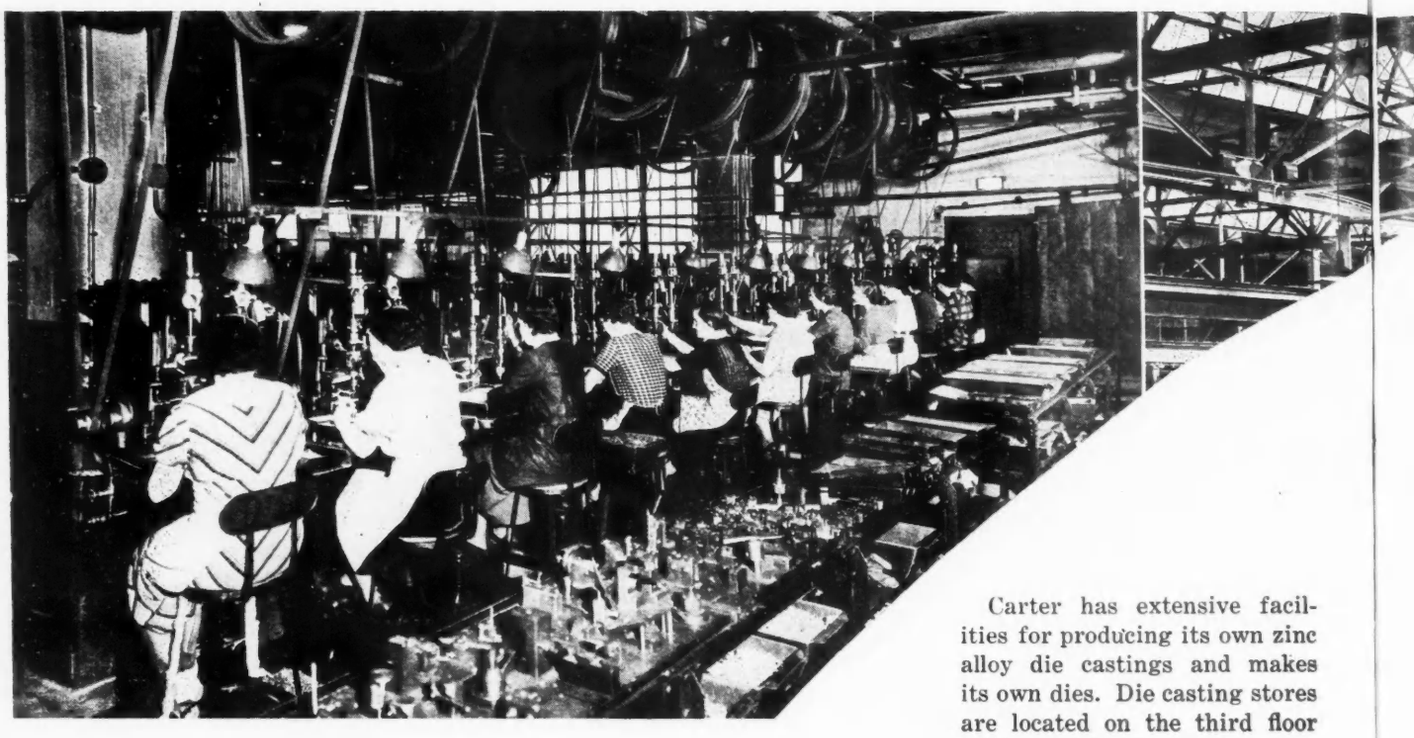
STATION (1) load. **STATION (2)** drill throttle shaft hole. Rough venturi bore (part way). **STATION (3)** finish rough venturi bore, radius and throat. **STATION (5)** semi-finish venturi bore. Spotface throttle. Lever stop lug. **STATION (6)** drill No. 30 low speed passage part way. Drill No. 30 pump discharge passage. **STATION (7)** step drill pump jet part way. **STATION (8)** drill 0.152 in. diameter pump jet. Step drill vertical balance vent. **STATION (9)** counterbore pump jet. **STATION (9)** 19/64 in. diameter, spotface for 45 degree balance vent. **STATION (10)** tap pump jet. **STATION (10)** Counterbore vertical balance vent. **STATION (11)** drill 3/16 in. x 45 degree balance vent. **STATION (13)** ream venturi bore. **STATION (14)** drill No. 30 pump intake passage (ball check to bowl). Drill 7 screw holes.

Kingsbury "C" Machine

STATION (1) load. **STATION (2)** drill 17/64 in nozzle hole. Finish step drill ball check. **STATION (3)** step drill nozzle hole. Counterbore ball check. **STATION (4)** counterbore nozzle hole. Blow out ball check. **STATION (5)** step tap ball check. Tap nozzle hole. **STATION (6)** drill No. 30 low speed air by-pass. **STATION (7)** drill No. 56 low speed air by-pass. **STATION (8)** tap low speed jet hole. **STATION (9)** drill spark control hole. **STATION (10)** flat bottom spark control hole. **STATION (10)** drill No. 5 metering pass jet to nozzle. **STATION (11)** tap spark control hole. **STATION (12)** drill No. 30 idle bleed hole. **STATION (13)** drill No. 54 idle bleed hole.

Kingsbury "D" Machine

STATION (1) load. **STATION (2)** drill No. 20 idle adjusting screw hole. **STATION (3)** drill throttle shaft hole. Drill No. 52 idle adjusting hole. **STATION (4)** spotface clearance on throttle boss. Drill 20 degree seat in idle adjusting screw hole. **STATION (5)** spotface idle adjusting screw boss. **STATION (6)** line ream throttle shaft hole. Tap idle adjusting screw hole. **STATION (7)** drill No. 30 economy passage. Mill clearance for pump cylinder. **STATION (8)** step drill for pump cylinder **STATION (9)** drill ½ in. diameter clearance for metering jet. **STATION (10)** ream for pump cylinder. Drill idle port hole. **STATION (11)** flat bottom idle port hole. Step drill metering jet hole. **STATION (12)** counterbore idle port hole. Tap metering jet hole. **STATION (13)** tap idle port hole. Tap 7 attaching screw holes. **STATION (14)** finish drill No. 30 low speed passage.
RUSTPROOF with Bonderizing equipment.
WASH and rustproof.



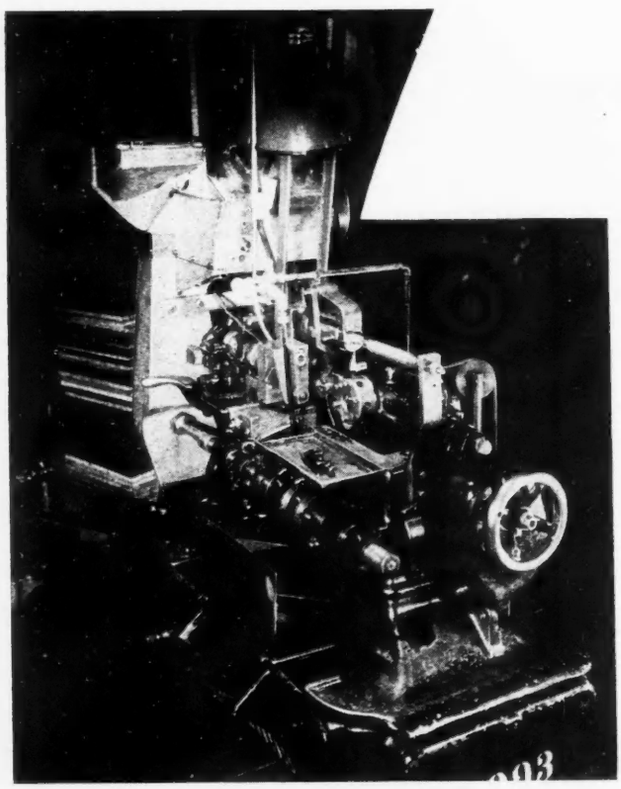
(Above) General view in the machine shop showing a section of the drill press department.

Carter has extensive facilities for producing its own zinc alloy die castings and makes its own dies. Die casting stores are located on the third floor convenient to the machine shop.

A number of small specialized operations are performed on this floor using ingenious equipment for the purpose. For example, the jet department is set up especially for the secondary or finishing operations on parts produced in the screw machine department. Here, too, will be found banks of inspection benches for the jets, for various small component parts, and for minor assemblies. One of the important inspection operations is that of checking needles on vacuum machines since the tolerance on the fine bores is so close as to make it impractical to check by mechanical measurement.

One of the fussiest of the fabrication jobs in this department is that of making the metering rod, on which are imposed extremely fine tolerances. Primary operation is that of swaging four different diameters at the end of the rod blank. From the swaging machines the work passes to a special forming machine

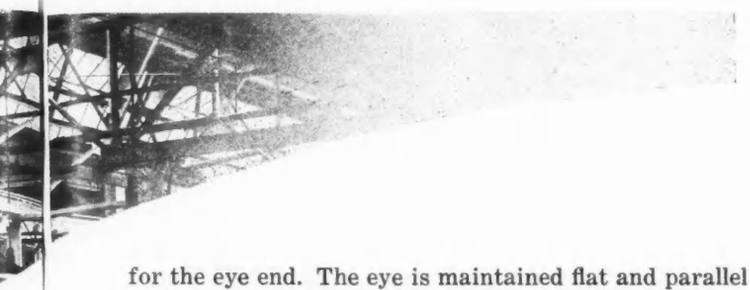
(Below) Example of hopper feed arrangement for handling small delicate parts is found on this No. 0 Brown & Sharpe. The operation is that of forming and cut-off of monel metal gasoline intake needle.



Factory Routing for

OPERATION AND EQUIPMENT

MAKE
Die cast machine
TRIM outline and venturi
Niagara punch press
REMOVE all BURRS (by hand)
TRIM FLASH from venturi. Drill ball check to pump and nozzle to metering jet. **DRILL** ball check to pump and nozzle to metering jet
Avey 4-spindle drill press
PUNCH anti-percolating slots. Tap seven upper flange holes. Drill No. 38 anti-percolating holes
Avey 4-spindle drill press
DRILL two pump jet holes, **COUNTERBORE** two pump jet holes. **PUNCH** two nozzle holes
Avey 4-spindle drill press
TAP nozzle holes. **DRILL** 3.1 mm. for press fit anti-percolating tube. **TAP** pump jet. **DRILL** pump discharge at 45 degrees
Avey 4-spindle drill press
DRILL 3/16 in. low speed holes. Drill No. 30 low speed holes. **TAP** four flange holes. **REAM** burrs from low speed holes (by hand)
Avey 4-spindle drill press



for the eye end. The eye is maintained flat and parallel with the axis of the rod, while the dimension between the geometrical center of the eye and a reference shoulder of the swaged end is held to a close tolerance.

Without going into the details of die casting machining, it may be noted in passing that raw die castings are inspected before delivery to the machine shop, given a final inspection after machining, then Bonderized and transported to final assembly. One of the factory routings reproduced here gives a typical sequence of operations in this machine shop.

Before leaving the machine shops, it is important to note that many of the operations have been tooled with Carboloy or Haynes-Stellite J-Metal, depending upon the requirements of a particular job. This type of tooling is found on all boring of cast iron and zinc, Carboloy being used exclusively in milling.

In view of the highly technical nature of the production process, the production engineering department has its own engineering laboratory which parallels, at least in kind, the type of laboratory equipment used by the research department. This provides a practical means of checking new production items against engineering specifications before releasing details for production.

The research and engineering laboratory has really extensive facilities for studying all phases of carburetion. It has its own tool room, life testing apparatus for various details, chemical laboratory, a comprehensive dynamometer laboratory, a group of six flow rooms. An important adjunct to the engineering department is the new cold room which is fitted with two electric dynamometers and is large enough to accommodate at least one full sized automobile for low temperature studies.

Die Cast Carburetor Body

OPERATION AND EQUIPMENT

COUNTERBORE low speed holes. **TAP** well jet. **DRILL** idle economizer.
Avey 4-spindle drill press
DRILL No. 30 pump intake to ball check. **TAP** two low speed holes. **DRILL** idle economizer. Drill No. 30 vacuum metering hole at 45 degrees
Avey 4-spindle drill press
BURR pump discharge by hand. **DRILL** No. 30 pump pump discharge. **DRILL** No. 44 vacuum passage at 30 degrees. **REAM** No. 30 idle passage
Avey 4-spindle drill press
DRILL through ball check. DRILL two idle bleed holes. **BURR** two economizers by hand. **RESEAT** ball check in pump intake
Avey 4-spindle drill press
BURR all holes by hand
WASH in degreaser
CORROSION TREATMENT
BLOW OUT after burring
BROACH, counterbore nozzle. **REAM** burr from ball check to pump
Avey 4-spindle drill press

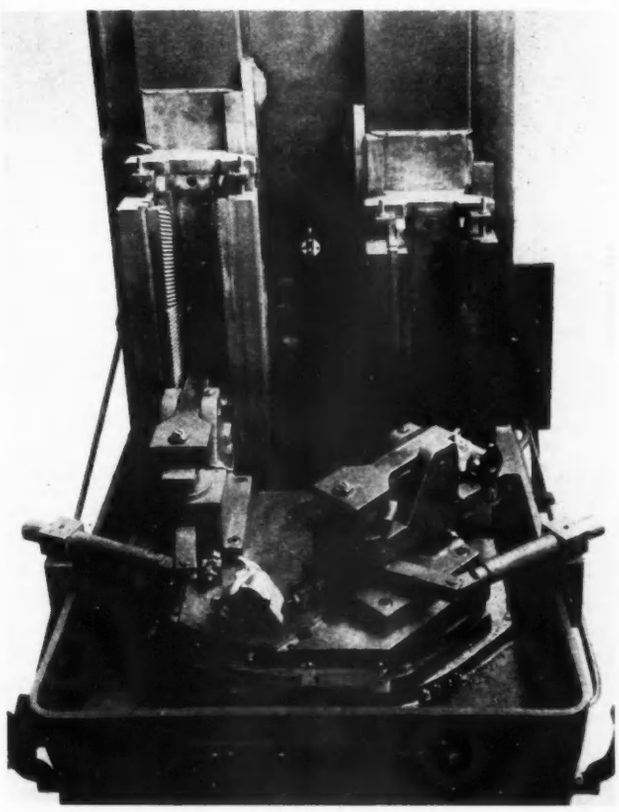
The company is particularly proud of its service garage maintained as a definite point of contact with the public and with repair shops of the vicinity. This garage is a part of the factory group but fronts on the main street where it is readily accessible. Apart from the public relations role of this garage, it offers the Carter service department a first hand contact with all manner of service problems encountered in the field.

Since quality control plays so vital a role here, it is only fitting that we close our brief perspective with some further comment on this activity. The inspection department is under the jurisdiction of the factory manager and parallels the factory organization in its function. For instance, the factory superintendent divides responsibility with the chief inspector. And in production departments there is an inspection foreman for each of the departments. Small wonder that there is an inspection man for every three production workers.

Depending upon the nature of the work and the tolerances imposed on various elements, many parts are subjected to 100 per cent inspection, others to a sampling inspection. In some cases there is 100 per cent inspection of the parts with only a spot checking of certain of its elements. Final inspection of carburetors as they come off the assembly benches is 100 per cent visual but flow bench testing of jets, and of complete carburetors is compulsorily 100 per cent.

(*Turn to page* 442, *please*)

(Below) An intimate view of the work-station of the Cincinnati 5-48 duplex vertical surface broaching machine tooled for finishing top and bottom flanges. This machine serves the battery of automatic drilling machines.



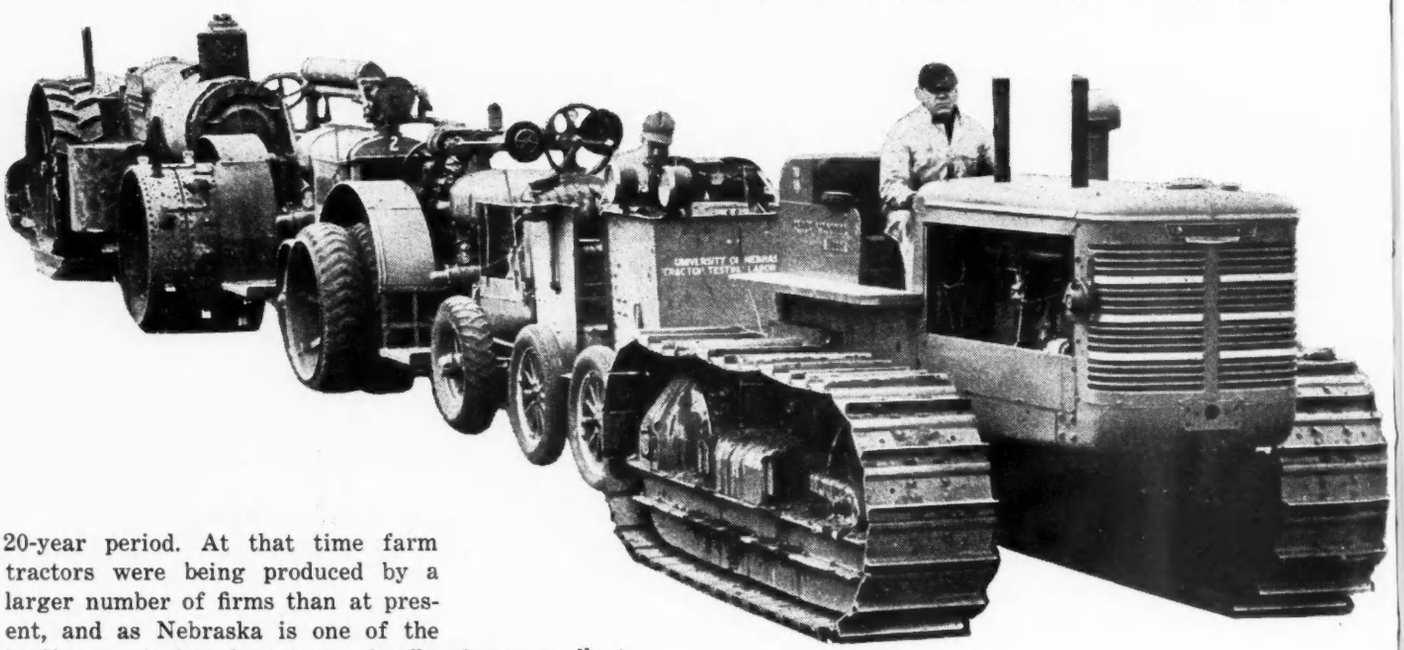
Twenty Years

By P. M. HELDT

DURING the year 1919 the State Legislature of Nebraska adopted a law which made it obligatory for manufacturers of farm tractors, before they could offer their machines for sale in that state, to submit a stock tractor for tests by the Department of Agricultural Engineering of the State University, and also to submit evidence that they had established a service station with a stock of repair parts within the state and "within a reasonable shipping distance of customers." The Agricultural Engineering Department at once began to buy and build the necessary testing equipment and to work out a testing program. During the 20 years which had elapsed up to the end of 1939, 328 tractors were tested, each representing a separate model put on sale by a manufacturer. In 1920 no less than 65 tests were made, a far greater number than the average for the entire 20-year period. At that time farm tractors were being produced by a larger number of firms than at present, and as Nebraska is one of the leading agricultural states and offered an excellent market, practically all manufacturers were anxious to qualify to offer their machines for sale there.

The requirements of the law reflect the difficulties and disappointments experienced by pioneer tractor operators. To fully understand the situation which led to the adoption of the Nebraska law it is necessary to go briefly into the early history of tractor development. Farm tractors were built in a more or less experimental way during the opening years of the current century. These, naturally, were quite crude and unreliable, and commercial development made only very slow progress. Most of the tractors marketed previous to 1913 were of a very large and heavy type, suited only for use on the large ranches of the Far West. Shortly before the outbreak of the World War the first moderate-sized, medium-priced tractors were produced, which met with a demand in the Corn Belt of the Middle West. Tractor designers, of course, profited by the advances in engine and transmission design which had been made in automobile engineering, but they were faced by numerous special problems, such as those arising from the high power factor of tractor engines in plowing, and from the rapid wear of cylinders and bearings due to the dusty atmosphere in which tractors must operate part of the time.

Then came the War, and the resulting sudden increase in prices of farm products and the shortage of farm labor created a rapidly rising demand for tractors. The industry passed through a boom period.



(Above)—Drawbar test on a crawler type tractor. These tests are carried out on a track reserved for the purpose.

(Right)—Drawbar test on a wheeled tractor. Note the instrument car attached to the tractor under test.

# of Tractor Tests

at Nebraska State University has given much practical information to both buyers and designers

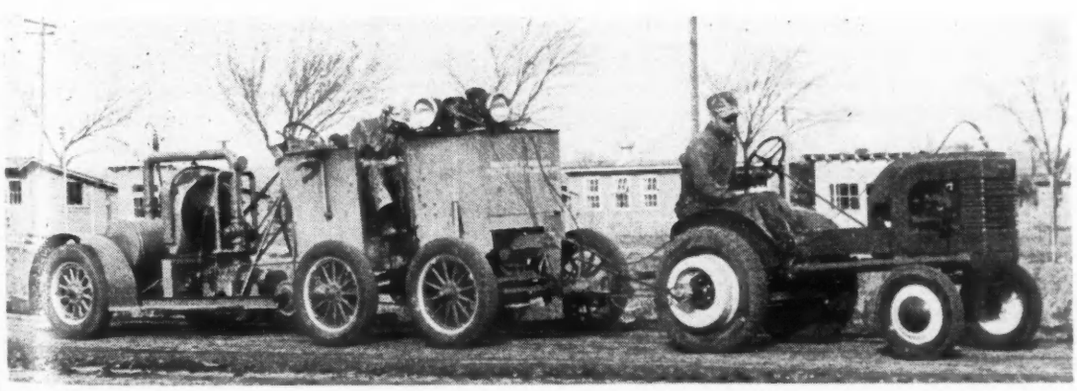
Many new companies were organized and went into production without much preliminary development work. As a result, many of the tractors sold to farmers fell far short of expectations. Some of them were incapable of developing the power which their ratings gave the purchaser a right to expect. There were frequent mechanical breakdowns, and if failure occurred during the plowing season and it was impossible to get repair parts promptly, the farmer often suffered heavy loss. Such unfortunate experiences naturally reacted unfavorably on the manufacturing industry, and this may explain why the industry as a whole never raised any serious objections to the Nebraska legislation. As a matter of fact, the industry realized from the beginning that keeping immature designs off the market would work out to its advantage, and it also realized that the official tests, by showing up weak points in existing tractors, would point the way toward improvement in design.

All tractors tested are certified by their manufacturers to be stock models and to conform to specifications filed with the application for test. Tractors are tested with the fuels which the manufacturers indicate to be necessary for their proper performances. Skilled operators employed by the University are in charge of the tractors during the tests.

Tests generally are divided into belt tests and drawbar tests. The former are carried out under four headings, viz., Test B, 100 per cent maximum belt test; Test C, operating maximum belt test; Test D, rated-load belt test, and Test E, varying-load belt test. These belt tests are preceded by Test A, a "limbering-up" run. The tractor is operated at approximately one-third rated load for four hours, two-thirds rated load for four hours, and full-rated load for four hours, each one of the forward gears being used during part of this run. During this test the manufacturer's representative is in charge, and he can make any adjustments he may deem necessary, provided they do not change the specifications of the tractor as furnished with the application for test. If any new parts or accessories are installed during this run, mention thereof is made in the official report of the test.

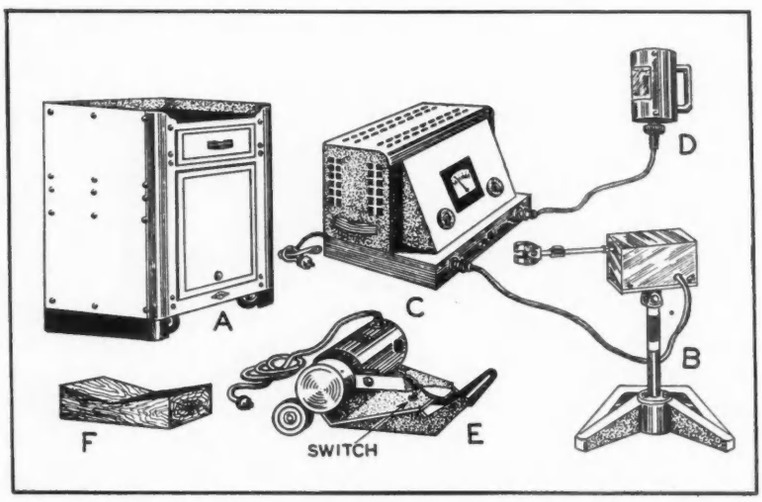
Belt horsepowers are determined by means of a G.E. electric cradle dynamometer, to which the engine is belted. No allowance is made for belt losses. A certain number of changes have been made in the test procedure in the course of the past two decades. For instance, up to the end of 1927 manufacturers' representatives were permitted to adjust carburetors for each load. From 1928 to 1934 all tests had to be made with one fixed carburetor setting. All reports issued from 1926 to 1936, inclusive, gave the highest permissible belt and drawbar horsepower ratings under the rating code of the American Society of Agricultural Engineers and the S.A.E. This code was revised in 1936 and then made no provision for determining horsepower ratings. At present the Board of Tractor Test Engineers, in arriving at the calculated rating given in its test reports, uses substantially the same method as embodied in the code prior to 1936. Runs are now made at 100 per cent maximum carburetor setting, and the results of these tests are given in the test reports, in addition to the operating-maximum test figures, which alone appeared in test reports previous to 1935. A three-page report is issued soon after a test is completed. Copies of these reports are sold at five cents each, and a subscription giving

(*Turn to page* 445)



Merrill Laboratories Design

Electronic Wheel Balancer



Units of Merrill wheel balancer and storage cabinet

MERRILL ENGINEERING LABORATORIES, Denver, Colo., have developed an apparatus for determining the direction and approximate amount of unbalance of a vehicle wheel while that wheel is in position on the vehicle. It can be used to determine whether the wheel is in static balance, that is, whether its mass moments are uniformly distributed around the wheel axis, and also whether it is in dynamic balance, that is, whether in addition the mass moments are equally distributed on opposite sides of a central plane perpendicular to the axis.

The apparatus consists essentially of five parts, viz., a pick-up device B, an amplifier C, a stroboscope D, a driving and brake unit E, and a rear-wheel support F. Part A is a metal cabinet which is offered as an extra item. It is handy for storing the parts of the equipment and it has a drawer in which tools and balancing weights may be stored.

The pick-up unit converts wheel vibrations into electrical impulses by electro-magnetic induction. When the wheel is not in static balance, it will vibrate in a plane perpendicular to its axis, and to detect such vibration the pick-up device is placed in a vertical position, with the magnet pressed lightly against a part of the car so that any vertical vibrations can be transmitted to it. To detect vibration due to dynamic unbalance, the pick-up device is placed in a horizontal position.

The apparatus can be used to balance both front and rear wheels of passenger cars of all sizes, and of trucks up to 1½ tons. In addition it will indicate bad wheel bearings and eccentric and bent wheel assemblies, which faults cause vibration that cannot be eliminated by the attachment of balance weights to any part of the wheel.

After the pick-up device has been placed in the proper position, the wheel is brought to its maximum speed by the drive unit, and is then allowed to slow down. If unbalanced, the wheel will be set in vibration, and the e.m.f. induced by this vibration is indicated by the meter on the amplifier. While the wheel slows down from its maximum speed it will pass through a speed of resonance, and the meter reading will then be a maximum. The stroboscope comprises a neon lamp which is lit up when the heavy part of the wheel is at the bottom (in determining static unbalance). By making a chalk mark on the wheel and moving the stroboscope until this chalk mark is shown by it, and then stopping the wheel and turning it until it is in the same angular position relative to the stroboscope, the direction of unbalance (which is then downward) is determined. The approximate amount of unbalance is shown by the meter reading. What is considered the proper weight to correct this unbalance is then secured to the wheel in the position opposite the chalk mark, and the test is run over. If this time the direction of unbalance is found to be the same as before, it shows that the weight added to the wheel was not enough, whereas if it is opposite, then too much weight was added. In this way, a proper balance can be achieved in a few runs, and the operator's skill in choosing the correct weight for any given meter reading will, of course, grow with experience.

Information reaching this country by way of Italy is to the effect that the construction and operation of the plant for the manufacture of the Volkswagen in Germany are being proceeded with according to plans, and that no arrangements have been made for the suspension of payments by those who placed orders for the car on the "budget plan," except in the case of individuals who have been called to the colors.

The Development of Sodium Cooling of Exhaust Valves

WITH increase in engine speeds the problem of keeping exhaust-valve temperatures within limits at which the valves would show a satisfactory life became quite serious. Operating temperatures of exhaust valves increase not only with engine speed but also with the valve diameter, that is to say, with the cylinder bore, and the problem became acute first in aircraft engines, which usually have larger bores than other high-speed engines. Serious valve trouble occurred first shortly before the outbreak of the World War.

As is well known, the heat absorbed by the valve head during the power and exhaust strokes is dissipated in part through the valve seat and in part through the valve stem and its guide. In water-cooled engines some improvement in cooling facilities could be effected by carrying the water jacket close to and all around the valve seat, and this expedient, quite naturally, was resorted to at an early date. But most aircraft engines of the post-war period were air-cooled, and while some improvement in valve cooling was possible by better finning of the valve pockets or cylinder heads, the greatest opportunity seemed to lie in improvement of the heat-flow path through the valve stems and guides. Owing to its comparative length and small cross section, the valve stem naturally offers considerable resistance to heat flow, and the idea of improving the heat-flow conditions by forming a chamber in the stem and partly filling this chamber with a liquid of high heat capacity, which would be reciprocated therein by the alternate opening and closing motions of the valve, occurred to engineers at a relatively early date.

Mercury was tried as a coolant for valves by the Royal Aircraft Establishment in England in 1913. However, mercury, will not wet steel, and therefore does not absorb heat readily from the valve head, for which reason the experiment failed. Another difficulty experienced was that it was next to impossible to confine the mercury, which would seep out through capillary openings in the closure at the end of the stem.

Midgeley and Kettering in 1917 patented a method of causing the mercury to wet the interior surface of the valve stems by tin-plating these surfaces, but this method, while quite effective, proved to be poorly adapted to quantity production.

After mercury had been found unavailable as a cooling medium, the next step consisted in inserting an aluminum rod in the hollow valve stem, aluminum having a heat conductivity about four and a half times as great as that of steel. But aluminum also has a coefficient of heat expansion roughly twice as great as that of steel, which rendered this scheme impractical. Next, resort was had to water as an internal cooling medium, although the unhappy results might have been foreseen. As with mercury, the valve stem was drilled out and the end of the hole in the stem was sealed after the chamber had been partly filled with water. The water was quite effective as a coolant, reducing the valve-head temperature by from 600 to 700 deg., Fahr., but even at the reduced temperature, steam would form in the chamber until a pressure of the order of 10,000 lb. per sq. in. was reached, which precluded satisfactory operation. Aniline was next tried, but decomposed at the high temperatures and left nothing but a mass of carbon. Another plan tried out experimentally was to cool the valve by oil circulation through its hollow stem and an outside radiator. This scheme was discarded because of its complication.

There were no further advances in exhaust-valve cooling methods during the period of the World War, although both cylinder sizes and engine speeds increased. During this period the U. S. Air Corps established itself and carried on engine development at McCook Field, Dayton, Ohio. There, also, much annoyance was caused by exhaust-valve failure due to overheating. The problems arising out of these troubles came within the duties of S. D. Heron, who is at present connected with the Ethyl Gasoline Corporation. He knew from previous experience that mercury and a number of other cooling media had proven unsatisfactory for the purpose, the mercury because it would not wet the iron or steel surfaces, and he was deeply impressed by the observation that the salts of salt baths used for heat-treating steel parts wetted the surfaces of the cast-iron pots in which they were kept so readily that they would creep up the sides and be lost over the upper edge. These salts were a mixture of sodium and potassium nitrates, with a melting point of about 450 deg. Fahr. and a boiling point of more than 900 deg. Fahr., which at that time was above the operating temperature of internally-cooled valves. It occurred to Heron that these salts should make an excellent cooling medium for valves. He filled a hollow-stemmed valve with these salts and operated it first under normal and then under violently detonating con-

ditions. An uncooled valve would have failed completely under these conditions long before the end of the 100-hour test. But the salt-cooled valve (as it was called) operated at "black heat" instead of at "red heat," and upon examination at the completion of the test was very little the worse for the punishment it had received.

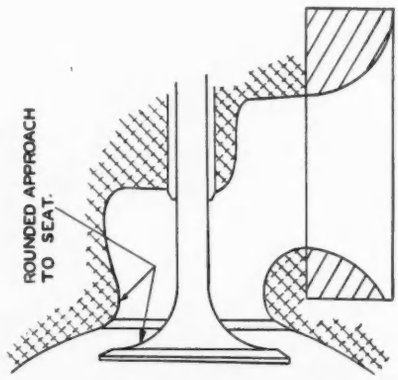
At that time a large number of aircraft-engine valves were supplied to the U. S. Air Corps by Rich Tool Company, and its chief engineer, Robert Jardine, was one of the first to become acquainted with the results of salt-cooling of such valves at McCook Field. He pledged the cooperation of his company's facilities in developing the system further. The first production use of salt-cooled valves is said to have been in the Wright J-5 engine of the Spirit of St. Louis with which Lindbergh made his memorable flight from New York to Paris on May 20, 1927.

The search for better cooling media continued and finally led to the adoption of metallic sodium, which has a much lower melting point (208 deg. Fahr.) and a much higher boiling point (1615 deg. Fahr.) than the salts, and whose specific gravity is less than one (sodium floating on water). In the early internally cooled valves only the stems were hollow, but at present both the stem and head are made hollow, hence the cooling medium comes closer to all points at which heat is absorbed, and the cooling action is more effective. At present practically all aircraft engines of more than 300 hp. have sodium-cooled valves, and such valves are used also in certain other heavy-duty engines.

Valve Port Design for Maximum Flow Capacity

C. D. WALDRON of Langley Memorial Aeronautical Laboratory, has investigated coefficients for intermittent flow through poppet valves, and his method and results are described in Technical Note No. 701 of the National Advisory Committee for Aeronautics. He found that flow coefficients determined under steady-flow conditions can be applied to intermittent-flow conditions without making corrections for valve-opening speed. A method is described which permits of accurately computing the overall flow coefficient of a valve with any lift curve. If the valve seat has a well-rounded approach and the flow coefficient is computed on the basis of the inside diameter of the seat it may be greater than 1.00.

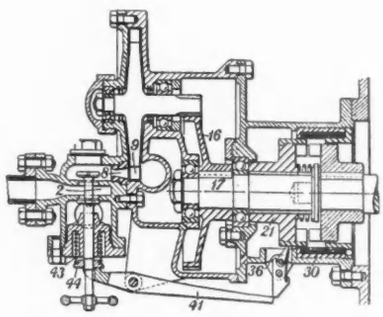
One of the illustrations accompanying the report, reproduced herewith, clearly shows how in modern aircraft engines both the valve and the valve port are rounded to prevent any sudden changes in the cross-sectional area of the valve passage, which would tend to cause eddies and obstruct the flow. This same principle is being applied also in the design of automobile engines with a view to raising their specific outputs, even though in L-head engines the valve passages cannot be as free and direct as in valve-in-head engines.



Section through valve passage of valve-in-head engine.

Explosive-Cartridge Aircraft-Engine Starter

A STARTER for aircraft engines in which a cartridge containing explosive gases is used to give several revolutions to an aircraft engine, through the intermediary of a gas turbine, has been patented in England



by the British Thompson Houston Company, Ltd., the associated inventors named in the patent being D. H. Graham, G. Tabberer, and B. E. G. Forsling. As shown in the annexed drawing (which is reproduced from *Engineering*), gases under pressure are supplied by the cartridge to the valve-chamber 2 which communicates with the turbine inlet and exhaust chambers. The valves, which are rigidly connected, are shown in the position at start. From the inlet chamber the gases expand through the nozzle 8 and pass through the runner blades 9 to the exhaust. The torque is transmitted through teeth on the runner shaft to the gear wheel 16 keyed to the shaft 17, which is splined to take the driving clutch half 21. This is provided with dogs to engage dogs on the driven clutch half, which is keyed to the engine shaft. A solenoid 30, mounted round the clutch, engages the halves and is connected in circuit with the heater plug which fires the cartridge. To prevent overspeeding of the turbine, in case the engine fires before all the energy in the cartridge has been expended, a trip is operated by the clutch half 21. A trigger 36 is held against part 21 by a leaf spring and engages the end of lever 41. A spring 43 holds washer 44 against the other end of the lever 41. The washer is threaded on the spindle carrying the inlet and exhaust valves, so that its position can be adjusted. When the solenoid circuit is closed and clutch half 21 is pulled into engagement, trigger 36 is pushed back by the spring. When the engine fires and clutch half 21 is pushed out of engagement, trigger 36 is hit and frees lever 41. Spring 43 then closes the inlet valve and opens the exhaust valve, so that the gases from the cartridge are diverted from the turbine to the exhaust.

AUTOMOTIVE INDUSTRIES

Just among Ourselves

A WEEK or so before the union-preference elections in General Motors plants, the Brookings Institution, Washington, published "Labor Relations in the Automobile Industry," by William Heston McPherson. The slim volume, a pioneering job in the field, presents an orderly and dispassionate discussion of the current problems facing those who look forward to labor stability in the industry.

The immediate objectives of the UAW-CIO, with respect to General Motors, were stated in advance of the election by Walter Reuther, who heads the GM department of the victorious union. The objectives, in outline, were as follows:

A general wage increase, introduction or extension of the shop steward system for handling grievances, an "improved" seniority plan, and joint adjustment by the union and General Motors of the manufacturing rate.

Considerable light on each of these objectives is found in McPherson's book. In writing about wage rates, for example, he points out that the wages of each company are determined largely with reference to the rates paid by its closest competitors in the neighborhood. There is some tendency, too, for manufacturers to "follow the leader" who breaks from the prevailing scale, either upward or downward because of prevailing conditions. In the case of General Motors, because of the recent Chrysler scaling upward, and the sweeping nature of the UAW-CIO victory, there will be considerable pressure in the direction of a wage increase.

General Motors has consistently resisted the extension of the shop steward system in an attempt to maintain the integrity of the foreman as the backbone of the automobile production plant.

It is possible that it will be necessary to make further concessions to the union, but that they will be accompanied by contractual limitations on the number of hours per day that a shop steward can spend in handling grievance procedure.

According to McPherson, there is a tendency among union officials to feel that "straight" seniority, without consideration of type of work on which a man is employed, or the plant division in which he is placed, is the only satisfactory standard. Certainly it is not the most satisfactory standard from the point of view of economic management. The word "improved" which Mr. Reuther uses, allows considerable latitude for compromise, and it seems probable, in our view, that while minor adjustments of seniority agreement may be in order, no sweeping changes are to be expected.

The question of adjustment, joint or otherwise, of the manufacturing rate, is probably the most ticklish one involved in Reuther's criteria, and in the new union solidarity. The so-called "speed up" was the stalking horse in the last and biggest Chrysler strike. McPherson feels justified in concluding his general study of the union attitude on manufacturing rates with the remark "the union [and this means any union in the saddle] definitely intends to reduce plant efficiency in so far as the speed of operations is concerned."

On the other hand, he found among union officials in general, a tendency to regard joint determination of the working rate as impractical, except where the fairness of the set rate was challenged by workers.

It seems probable to us that the outcome of this dilemma will be sought for in improved grievance machinery on the question of manufacturing rate, without any yielding by General Motors of its management function in this particular.

It may be concluded that the UAW-CIO victory in GM elections points the way to simplified negotiations, but refurbishes some issues which have been quiescent while the unions have been gathering strength.

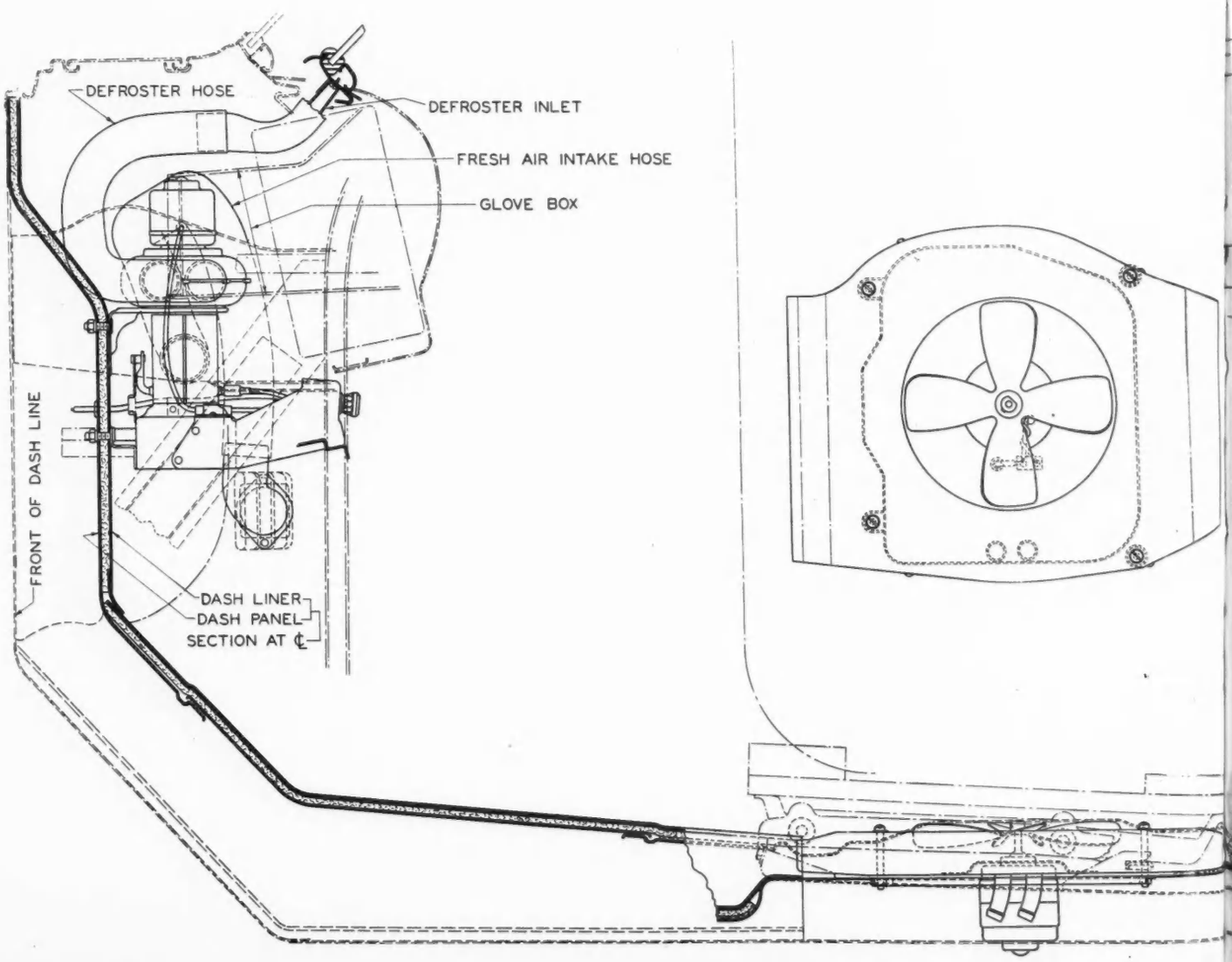
France Looks to the Future

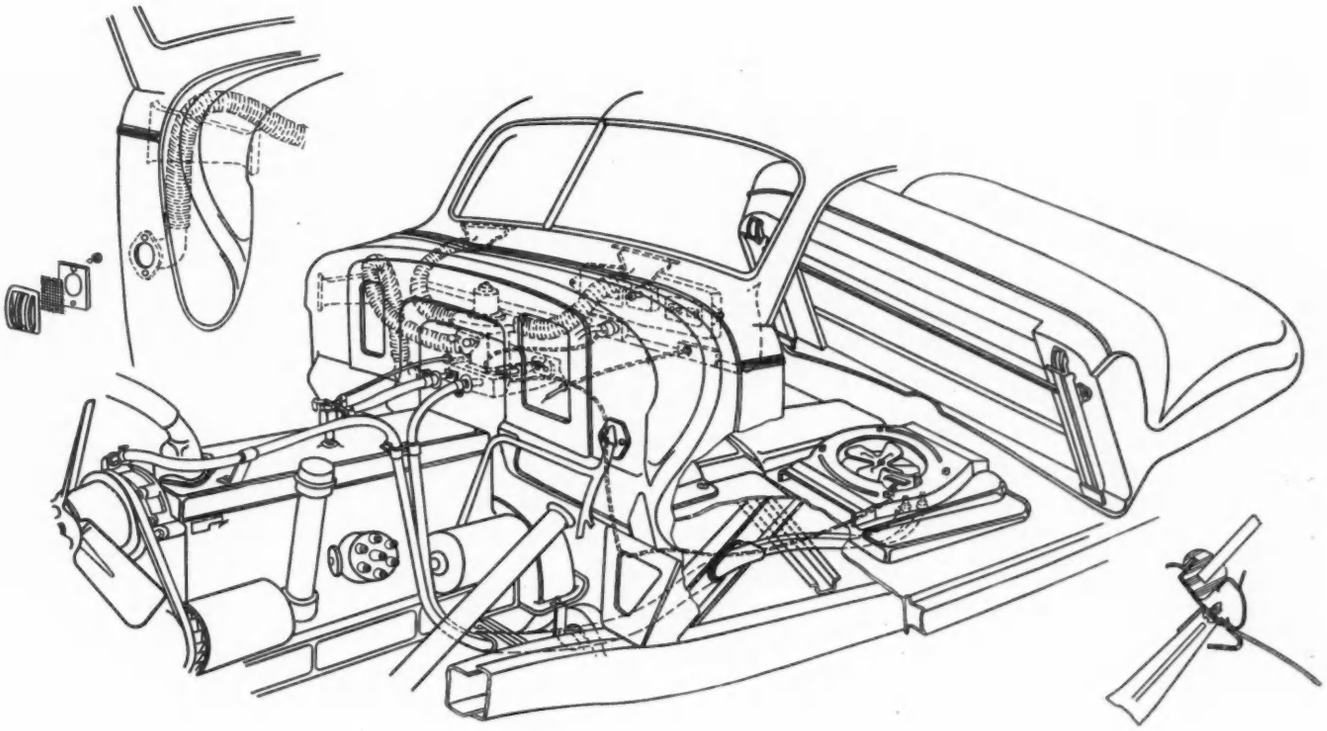
It seems worth while to call attention to the fact that the clear mentality of the French nation is already concerned with *after*-war preparations. For several months it has been impossible to get authentic news from French sources, about automotive happenings. When the first information began to trickle through it was concerned with French thinking toward post-war conditions. This is an incredible and welcome note of sanity in an otherwise crazy world. While it probably doesn't do much except brush off the old versicle we all learned in school about "hope (or was it truth?) crushed to earth, shall rise again," it should make someone in France eligible for a Nobel hoping-for-peace prize. The French have evolved a plan to reserve some of the nation's brain power to plan for the country's return to normalcy, or whatever phrase is coined to meet the period when the boundary lines on the map of Europe settle down for a while. Automotive engineers in France are among the leaders in the movement to plan ahead.—HERBERT HOSKING.

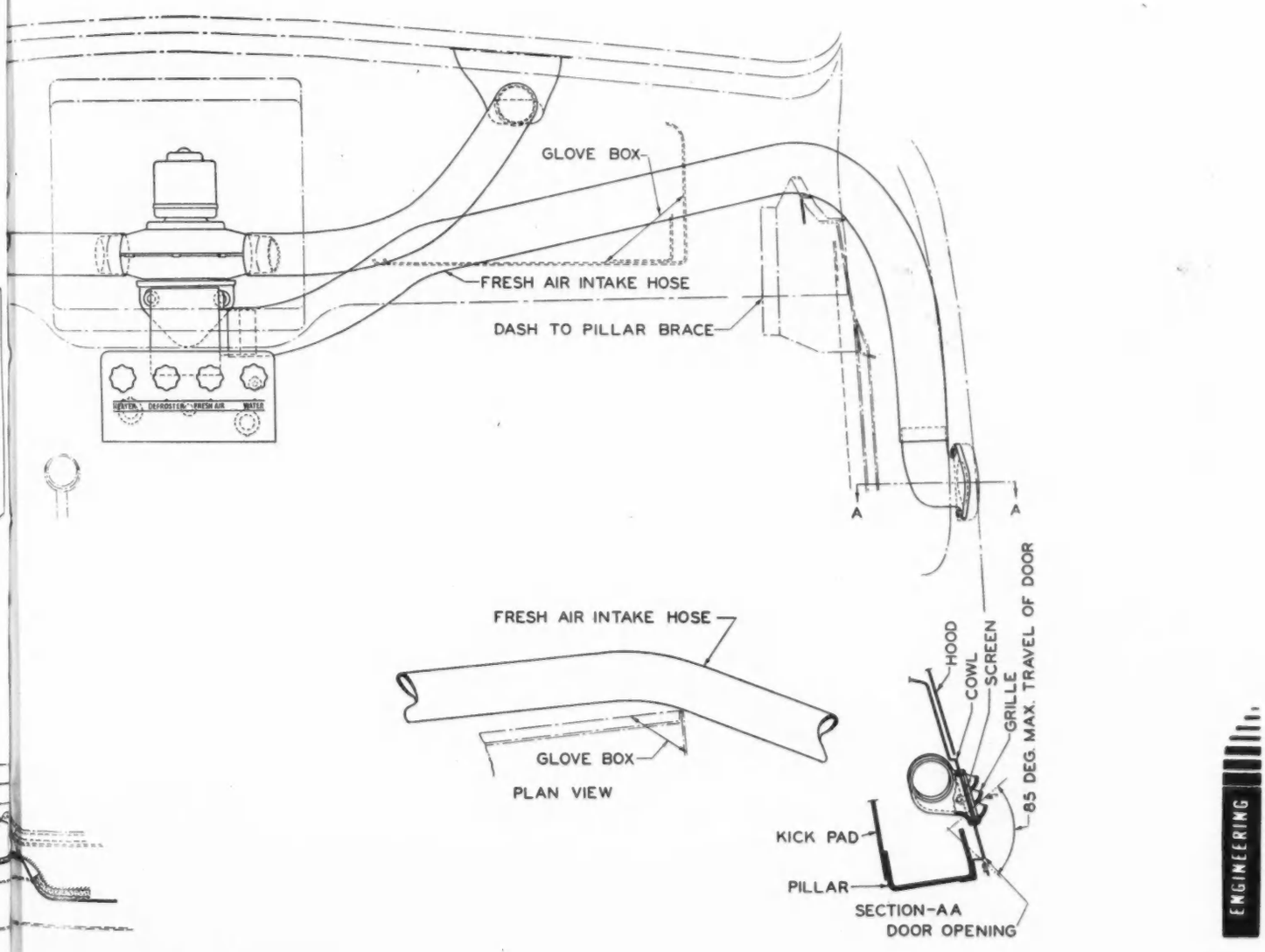
PONTIAC 1940 UNDERSEAT HEATER and DEFROSTER INSTALLATION

The drawings on these two pages show the installation of an underseat heater and defroster unit on the 1940 Pontiac. This installation is optional with the conventional dash-mounted heater. The defroster unit, which is mounted centrally on the dash under the cowl, is provided with a fresh-air intake, the inlet to which is located at the right side of the cowl and is covered by a screen and grille. This unit, of course, is similar to a heating unit in that air moved by a blower is passed through a radiating unit through which hot water from the engine cooling system is led, the air thus heated being discharged through nozzles at the base of the windshield sections. Connections from the fresh-air inlet to the defroster unit and from the latter to the defroster nozzles are made by hose.

To install the heater under the driver's seat, screws at the front of the seat track must be removed and the seat slid back to disengage the anchorage, and then tilted backward. Water connections are made to the engine at the pump in front and at the center of the cylinder head. At the latter point a water shut-off valve is installed. The two pieces of hose and the wire for the motor of the underseat heater are carried through a "cover" which is passed through the cross member and through a bracket at the clutch and then under the engine side-pan brace. The wire from the heater is connected to the open terminal of the heater switch on the dash. Four control knobs for the heater and defroster units and for the fresh-air supply are arranged centrally below the instrument panel, one of the knobs being for the water-control valve. An advantage of the underseat heater installation is that it heats the front and rear compartments of a car substantially equally.







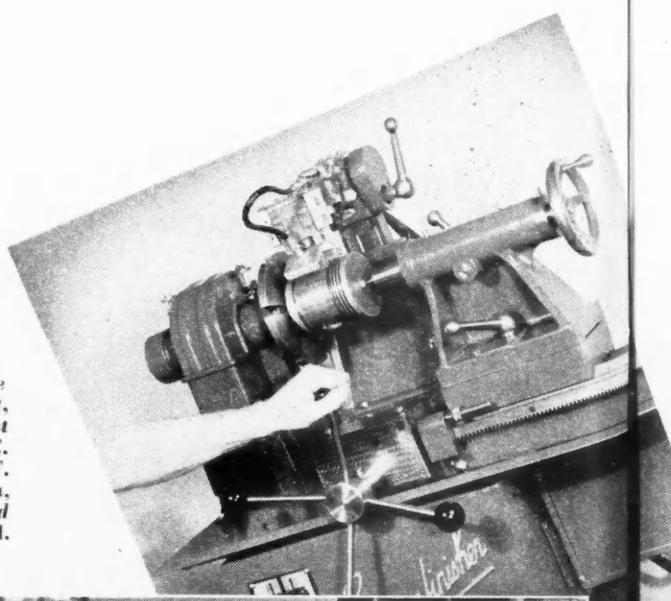
ENGINEERING

MEN and MACHINES

LAST month at Rochester, N. Y., the Gleason Works observed the seventy-fifth anniversary of its founding. Participating in the celebration were more than 7500 employes, residents of Rochester and out-of-town guests. Guides conducted small groups through the gaily-decorated plant. Signs above various machines explained key operations. There was dancing, a band concert and food for all.

In an address delivered before some 200 leading figures in the machine tool, gear manufacturing, automobile, aircraft and steel industries attending the ceremonies, James E. Gleason, president and general manager, proudly proclaimed, "In the next 25 years we will have changed the entire machinery equipment three times, and it is doubtful if any of the present buildings will be standing. That will only be keeping up with the general average."

When organized in 1865 the Gleason firm had fewer than 50 employes. Shop hours were the standard of post-Civil War days—66 per week. The company built a general line of machine tools with particular emphasis on engine lathes and planers, but in 1874 the founder, William Gleason, developed a bevel gear planer of a form-copying type for cutting the teeth

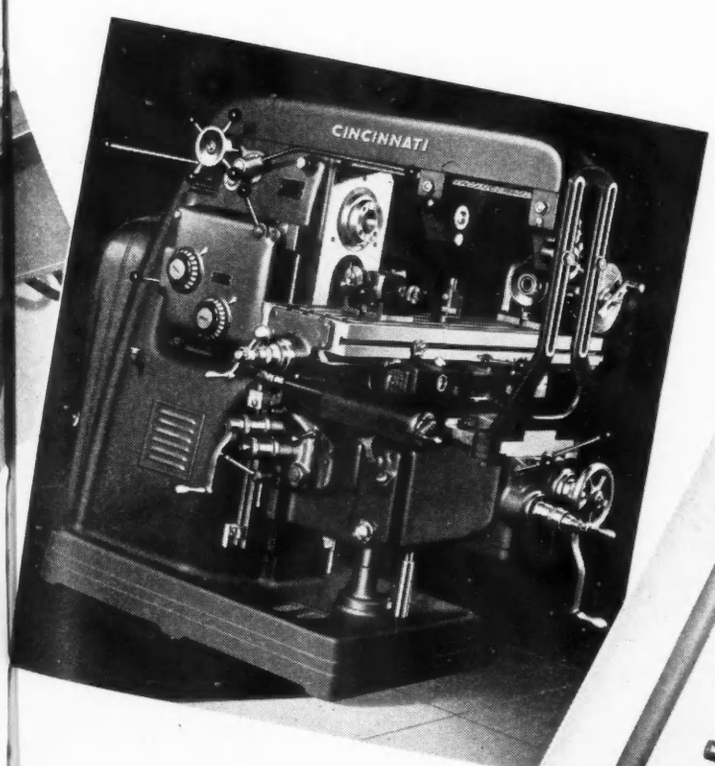


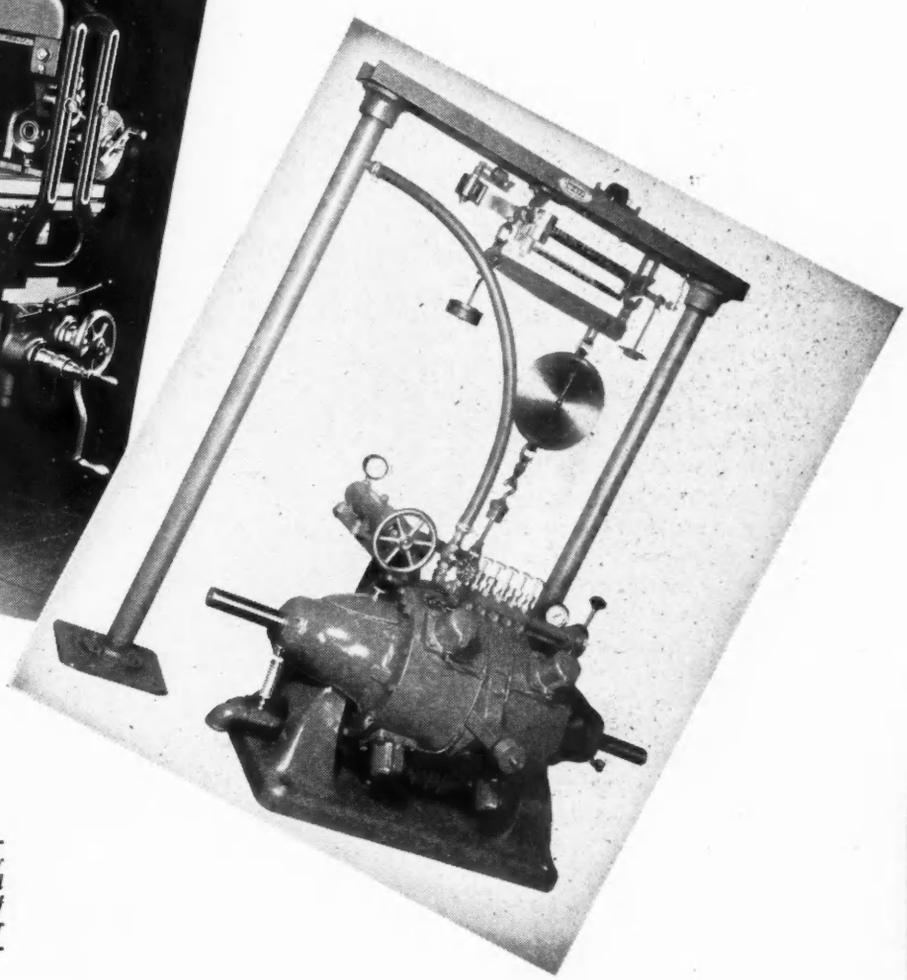
Among the prominent individuals attending ceremonies celebrating the seventy-fifth anniversary of the Gleason Works were, left to right, Edward G. Miner, chairman of the board of the Pfaudler Co.; August H. Tuechter, president, The Cincinnati Bickford Tool Co.; James E. Gleason, president and general manager of the Gleason Works; Frida F. Selbert, secretary, National Machine Tool Builders Association; C. Bush, Charles Selinger Co.; Clayton R. Burt, president, Niles-Bement-Pond Co.; Joseph L. Trecker, vice-president, Kearney & Trecker Corp.; E. A. Muller, president and treasurer, The King Machine Tool Co.

of straight bevel gears. Bevel gears had been made previously with integrally cast teeth or by inserting wooden teeth in a cast-iron ring. With the development of a practical machine for their manufacture, a gradual but increasing demand arose for cut bevel gears. By the turn of the century the company gave up its general line of machine tools and concentrated on the manufacture of machinery for producing bevel gears.

In 1905 James E. Gleason developed what is known as the two-tool bevel gear generator. This machine marked a definite advance in the art of bevel gear cutting. It produced smoother and quieter gears in half the time originally required and found a market in the infant automobile industry. The founder developed in 1913 a process and tool for cutting the teeth of spiral bevel gears that for the first time made such gears commercially practical. Arthur L. Stewart was the designer of the machine used in the new process. Another revolutionary gear development pioneered by Gleason was the invention in 1925 by Ernest Wildhaber of a process and machine for the manufacture of the hypoid gear. In 1937 came the Zerol bevel gear, whose teeth are curved longitudinally but without a spiral angle. As the art of gear manufacture advanced, Gleason developed equipment for testing, burnishing, hardening, lapping, and grinding straight bevel, spiral bevel, and hypoid gears and for making the tools employed on the cutting machines. Today this 75-year-old firm builds machines for manufacturing gears all the way from a small fraction of an inch in diameter to over 40 ft. in diameter.

THE Cincinnati Milling Machine Co. has placed on the market a line of new plain, universal and vertical dial type milling machines. They are built in three sizes and two speed-feed ranges, medium speed and high speed.





(Upper left)—Close-up view of universal superfinishing machine built by Ohio Units; (Center) No. 2 universal dial type milling machine, product of Cincinnati; (Right) One of the Taylor "Lo-Speed," "Hi-Torque" dynamometers with Prony brake.

Speeds and feeds are controlled by a single lever at the front of the machine. This lever is extended to the operator's rear working position. It has two positions, "speed" and "feed." When moved to the "speed" position, for example, the speed dial at the left-hand side of the column rotates. When the lever is returned to neutral, the dial stops, and the proper gears are in mesh to obtain the spindle speed indicated by an arrow. Feeds are changed in the same manner.

Power control and hand adjustment levers are grouped conveniently at the front operating position. All controls, both hand and power, are duplicated at the rear working position (at the left-hand side of the column). Power longitudinal, cross and vertical feeds are engaged by independent feed levers. Feed movement is in the direction in which the lever is moved. All sizes and styles of the machines have power rapid traverse in six directions.

Spindle mounting conforms to the Cincinnati design of four anti-friction bearings—two at the front end and two at the rear end. Rear bearings are mounted in a sleeve to permit normal expansion and contraction in the length of the spindle. Automatic lubrication of the principal units reduces daily attention to little more than a quick inspection. All parts within the column and knee units are lubricated automatically, while the parts within the saddle are lubricated by a single oil-shot system.

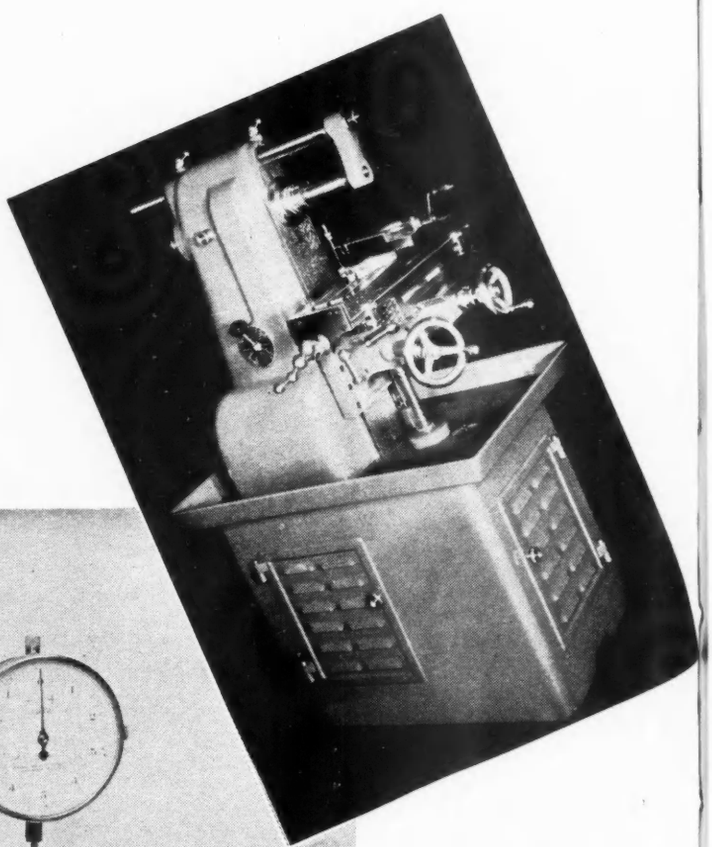
A new hydraulic device has been incorporated with the spindle drive starting lever. Connected with the link mechanism, a hydraulic Servo control takes over the work of engaging the clutch, relieving the operator of all starting effort except a light touch on the starting lever. This design permits the spindle to be "inched" along with negligible effort. There is positive and full engagement of the clutch when the spindle is rotating; engagement is instantaneous; and, inasmuch as the Servo control also operates the spindle brake, the spindle rotation stops instantly when the clutch is disengaged.

Micrometer dials have been redesigned to provide greater convenience, added safety, and increased accuracy of setting. Finely spaced face clutch teeth, having a triangular cross section, engage mating teeth in the sleeve on the adjusting screw. Spring pressure keeps them in engagement, making it impossible to lose accidentally their original setting. When it is necessary to reset them, they may be pulled out a slight distance against the spring pressure, rotated the desired amount, and then released.

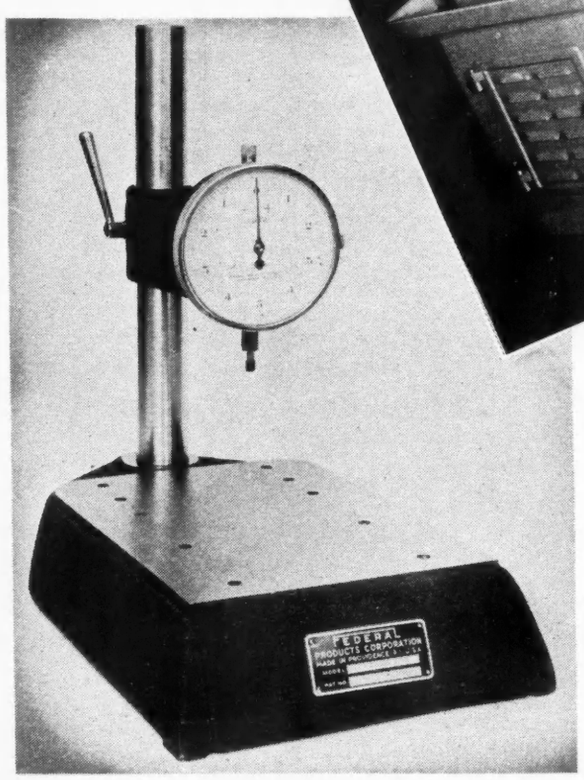
Another safety feature of major importance will be found in the motor cut-out switch at the rear of the machine. If the operator opens the hinged cover for a belt tension adjustment or a routine motor inspection, and has forgotten to shut off the power, a cut-out switch immediately breaks the circuit, thereby stopping the motor.

A new type of brace is included as standard equipment with horizontal machines. It clamps to the exposed top surface of the knee and, therefore, may be set as close as desired to the saddle. With this design, the operator may take advantage of the combined rigidity of short arbors and the brace.

TAYLOR MFG. CORP. of Milwaukee, Wis., has announced an improved line of "Hi-Eff" hydraulic dynamometers. These units are of the power absorption type, although the company can furnish friction, draw-bar, transmission, chassis and special types. A "Lo-Speed," "Hi-Torque" hydraulically actuated, manually operated, water cooled Prony brake for testing slow speed prime movers is available for many models. Reversible "Hi-Eff" dynamometers for marine engine



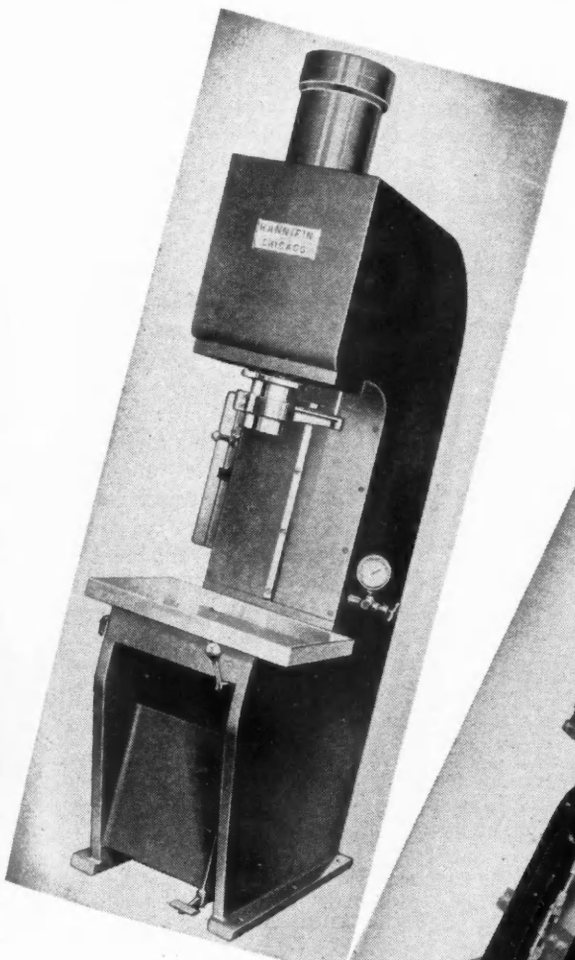
(Above)—Model TM Hardinge precision preloaded ball bearing tool room milling machine.



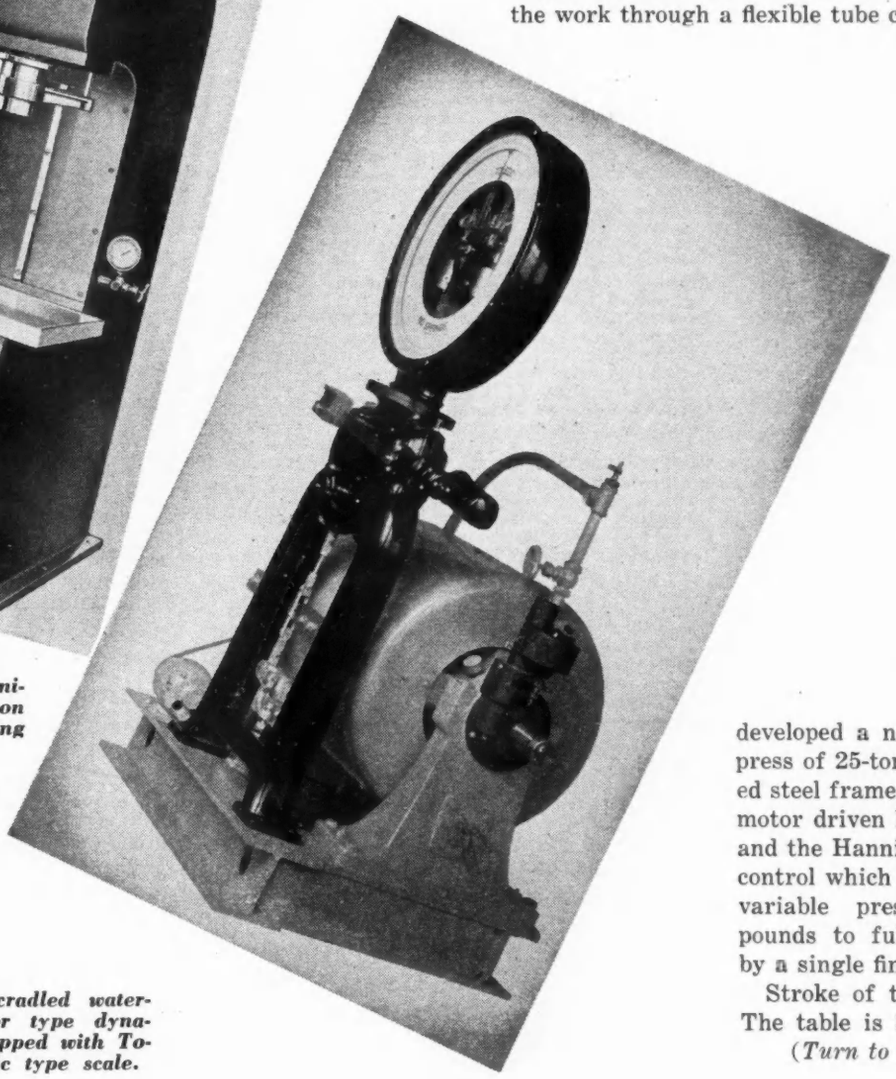
(Left)—Improved Federal Products comparator designated as Model NB-60.

and similar testing also can be supplied by Taylor.

The standard Taylor "Hi-Eff" hydraulic unit includes torque arm, large dial scale, pressure gage, thermometer, micro-intake and exhaust valves, double-extended key-seated shaft, balanced rotors, ball bearing cradled stator and one-piece vibrationless base. It is claimed that the "Hi-Eff" assures accurate data, economical performance, wide range capacity and high-speed testing. Further, the manufacturer points out that the hydraulic, shaft bearing and packing gland torques are all indicated on the scale. Only the cradle bearing torque is eliminated and this is said to be ordinarily less than 3/10 of one per cent. There are no contacting surfaces between the stator and rotor, and only three to four gallons of water per b.hp. hour are required ordinarily. Seventy-two different models are offered with capacities up to 10,000 hp.; speeds up to 25,000 r.p.m. Model D-24 will calibrate from 10 hp. at 1000 r.p.m. to 450 hp. at 6000 r.p.m.



(Above)—Hannifin's new 25-ton hydraulic forcing press



(Right)—GE cradled water-cooled inductor type dynamometer; equipped with Toledo automatic type scale.

OHIO UNITS, Toledo manufacturer of precision machine tools and automotive parts, now operates under license from the Chrysler Corp. to build a universal superfinishing machine intended for use in tool rooms, on small production items, and for the automotive replacement trade. The model N-301 general purpose machine is designed for superfinishing crankshafts, brake drums, flat surfaces, such as flywheels, disks, and other parts. A close-up view of the unit is included herewith.

An oscillating head which carries the superfinishing stones is mounted on a carriage which may be traversed manually to permit the stones to come in contact with the full length of the work. The head may be adjusted quickly to any position required, depending on the size of the work, and is driven by a flexible shaft from the main driving motor. Tension of the stones against the work is controlled through an ingenious spring adjusting device which may be changed instantly to the tension desired.

A gear type pump with a maximum capacity of 1½ gal. per min. is mounted in the base. The pump is driven by the motor which furnishes power for the entire machine and from it lubricant is delivered to the work through a flexible tube connection.

Specifications of the machines are as follows: 14-in. swing over the bed; 11 5/16-in. swing over the carriage (raising block is available for the head and tail stocks, increasing these capacities to 17⅞-in. swing over the bed and 15½-in. swing over the carriage); tail stock center travel, 4⅜ in.; length between centers, 49 in. max., or 63 in. on special order.

HANNIFIN CO., Chicago, has developed a new hydraulic forcing press of 25-ton capacity, with welded steel frame construction, built-in motor driven hydraulic power unit, and the Hannifin sensitive pressure control which provides an infinitely variable pressure from a few pounds to full capacity controlled by a single finger tip control lever.

Stroke of the machine is 24 in. The table is 30 by 22 in.; gap 25

(*Turn to page* 443, *please*)

Eastman Report Shows

(*Continued from page* 402)

liberal in rendering public aid to any and all rail lines from their inception to the present time.

The Eastman Report shows there was hardly any of the states and their political subdivisions that did not render public aid to some railroad or other. These aids are summarized by the Eastman Report as shown in Table A.

The actual public aids to rail lines were considerably more than shown. The report shows only what it calls net aids. It deducts for reduced rates granted the government and for expenses of rails in connection with other aids. I think that the gross should have been reported and these so-called deductable items noted for what they are worth. But again, that is a matter of opinion.

Perhaps one of the greatest aids which railroads received from the time of their inception to considerably after the turn of the century was the slowing down of the development by the government of navigation improvement of the many excellent rivers and other inland waterways. Had the State and Federal Governments continued the internal improvements planned, particularly that of the natural arteries of trade, all during the construction of rail lines, many of the latter would have had far more financial difficulties and in consequence would have experienced longer delay in their projected construction.

The report shows that the Federal Government has from rail crises to rail crises during the last 112 years of rail history come to the aid of them with legislation designed for their benefit and financial assistance. And it is right and proper that the national and state governments should encourage and assist all manner of transportation to keep thoroughly abreast of the national needs. Transportation by air, railroad, motor, water or pipe line are the arteries through which we serve each other. Those arteries ought never to be allowed to get in such condition that our ability to secure the most efficient and economical transportation service is imperiled. This is just as important as keeping our air forces, our Army, Navy and Marine Corps in readiness to respond to the nation's needs. Without adequate transport these would be of little avail.

Perhaps the most important of all transportation facilities in point of national benefit are our magnificent highways, streets and roads. These have been made possible, as shown by the Eastman Report, by the enormous tax burden imposed upon all those who own and operate automotive vehicles from the most lowly and antiquated flivver to the great public transportation vehicles that have served, among others used, to bring the far-distant farm and dairy products to our tables all times of the year as fresh as those in season home grown. Among other benefits to us they have tended to give farm products, the substance of nearly half our population, wider and freer markets. During the past decade the rail lines have battled in the legislative halls from coast to coast, national, state and local, to halt the advance of motor vehicle competition. They asserted far and wide that we who own automobiles, trucks and buses were being subsidized by the government in that we did not pay sufficient for the government facilities we used. On the other hand, motor vehicle users not only pay their way, but pay more than they should, as shown by the Eastman Report. The figures in Table B are from Table 28 of Volume IV, and cover the period 1921-1932, both years inclusive.

Table A. Summary of Public Aids Given to Railroads

Form of Aid	Amount of Aid*
A. To secure construction of railroads:	
Drawbacks of duties on railway iron, and expense of Federal railroad surveys	$6,000,000
Federal and State land grants	429,000,000
Federal and State right-of-way grants.	87,000,000
Lands donated for right-of-way and other carrier purposes by local governments, individuals, associations, and private corporations, including apparent aids	232,000,000
Contributions of cash, material, equipment, construction, labor, and securities by states, local governments, individuals, associations, and private corporations in aid of construction	63,000,000
Loans by Federal Government in aid of construction of Pacific railroads	48,000,000
Loans by States and local governments in aid of construction	46,000,000
Guaranty or endorsement of railroad bonds by States and local governments	25,000,000
Tax-exemption aid to railroads by States and local governments	13,000,000
Aids to railroads by States through grants of banking privileges	1,000,000
Subscriptions to railroad stocks and bonds by States and local governments	50,000,000
Collective subscriptions to railroad stocks by citizens	87,000,000
Vacation of streets to railroads	77,000,000
Rights in public domain	118,000,000
Total, Section A	$1,282,000,000
B. Aids given from World War to 1936:	
Loans by Reconstruction Finance Corporation	$115,000,000
Loans by Federal Emergency Administration of Public Works	46,000,000
Total, Section B	$161,000,000
Grand total, all aids to railroads	$1,443,000,000

* Amounts shown in some instances reflect a rounding off to nearest million.

Motor Taxes Diverted

While that is very interesting and enlightening from an historical standpoint, it deals with the highways during a vast expansion period when we were wildly building them hither and yon. So it will be well to see what Mr. Eastman's experts reported for the period from 1933-1937, both years inclusive, shown in Table C taken from Table 61, Volume IV.

So, there's the proof that motor vehicle owners or highway users, as you please, are not now nor have they been subsidized. This is as the Interstate Commerce Commission experts have determined. An examination of their figures of annual excesses or underpayments by motor highway users for highway costs for the entire period from 1921 to 1937 shows annually that since 1927 they have paid more toward the cost of highways than they ought to have paid. In the earlier years, however, they paid somewhat less than they should.

These annual excesses or deficiencies are interesting in that they show a growing tendency to burden motor vehicle owners with more and more taxes which, in fact, are not needed for highway purposes. According to the Eastman Report this has been strikingly true beginning with 1933, when the taxes and other payments of motor vehicle owners were only $7,102,000. Beginning about 1934, and still in progress, a very intense campaign has been waged by and between the rails, motor and contract carriers, and highway users over whether the latter are paying all they ought to pay for the use of the public roads.

The annual excesses of payments over costs are found by the Interstate Commerce Commission experts to have been: 1933, $7,102,000; 1934, $47,776,000; 1935, $86,177,000; 1936, $92,851,000; 1937, $154,000,000.

Table B. Collected from Motorists 1921-1932

1. **Payments by Motor Vehicle Owners:**	
(a) Gasoline taxes	$3,011,386,000
(b) Motor vehicle registration fees	3,232,333,000
(c) Miscellaneous state taxes	76,169,000
(d) Municipal motor vehicle taxes*	126,360,000
(e) County and local motor vehicle taxes*	10,897,000
Total payments of taxes by motor vehicle owners	$6,457,145,000
2. **Deduction from Payments:**	
(a) Cost of administering gasoline tax receipts*	11,929,000
(b) Cost of administration of registration fees*	200,398,000
(c) Personal property taxes included in registration fees*	111,885,000
Total deductions from payments	$324,212,000
Total motor vehicle payments less deductions*	$6,132,933,000
Total cost of all highways, roads and streets	5,994,761,000
The amount that highway users paid above the cost of highways	$138,172,000

* Estimates.

Table C. Collected from Motorists 1933-1937

1. **Payments by Motor Vehicle Owners:**	
(a) Gasoline taxes	$3,143,636,000
(b) Motor vehicle registration fees	1,684,768,000
(c) Miscellaneous state taxes*	76,011,000
(d) Municipal motor vehicle taxes*	60,000,000
(e) County and local motor vehicle taxes*	5,000,000
Total payment of taxes by motor vehicle owners	$4,969,415,000
2. **Deductions from Payments:**	
(a) Cost of administration of gasoline taxes	21,884,000
(b) Cost of administration of registration fees	120,758,000
(c) Personal property taxes included in registration fees*	75,000,000
	$17,642,000
Total motor vehicle payments less deductions	$4,751,773,000
Total cost of highways, roads and streets assignable to motor vehicle users	4,363,807,000
The amount that highway users paid above the cost of highways	$387,966,000
Total excesses paid by motor carriers 1921—1937	$526,138,000

* Estimated.

It is well known among informed persons that conditions of motor vehicle taxation have gotten much more burdensome with the passage of time. That is, the burden of motor vehicle taxes and other charges collected from you and from me and all other highway users was quite materially increased during 1938 and 1939. This Eastman Report ought to furnish ample proof of the unequal and wholly uncalled-for taxation presently imposed upon we who own or use motor vehicles.

On the other hand, when it comes to taxation it should be remembered that courts have only interfered with this function of government when it sought to single out and discriminate against parties properly classed together for purposes of taxation.

Finally, the Eastman findings dismiss the principles that the States of Illinois and Missouri use for taxing motorists by treating roads as a public utility and attempting to make charges on the theory of that of a private utility operating for profit on a fair return on a fair value basis.

This Report did not give credit to motorists for either the Federal taxes paid by them nor to the funds diverted from roads to other uses. And the Report showed that in 1932 only school buses, private trucks of 1½ tons capacity and less, 5-ton private combination vehicle, and private cars for hire, 5-ton straight trucks failed to pay their way. However, other motor vehicles were charged more than enough to make up

EXHIBIT

Comparison of Costs Per Vehicle, by Vehicle Groups, With Payments Made, 1932

(Taken from Public Aids to Transportation, Vol. IV)

Class of motor vehicle and rated capacity	Cost per Vehicle	Payments per Vehicle	Payments minus assignable costs
Passenger cars	$26	$26	$—
Taxicabs and other for-hire cars	61	81	20
School buses	82	77	—5
Contract buses (seats):			
7 and less	41	56	15
8 to 20	46	113	67
Over 20	59	178	119
Common carrier buses (seats):			
7 and less	126	143	17
8 to 20	142	290	148
Over 20	188	437	249
Trucks (capacities in tons):			
Private: Farm	20	25	5
Other private			
1½ and less	53	48	—5
Over 1½ and less than 3, single	67	92	25
Over 1½ and less than 3, combination	104	133	29
3 and less than 5, single	151	185	34
3 and less than 5, combination	129	206	77
5, single	287	256	—31
5, combination	311	277	—34
Over 5, single	316	358	42
Over 5, combination	372	457	85
For-hire:			
1½ tons and less	102	105	3
Over 1½ and less than 3	152	178	26
Over 1½ and less than 3, combination	157	226	69
3 and less than 5, single	251	282	31
3 and less than 5, combination	193	349	156
5, single	457	403	—54
5, combination	457	465	8
Over 5, single	499	594	95
Over 5, combination	545	832	287

Minus sign (—), excess of costs over payments.

the deficiency. Unquestionably in the period from 1933 to 1937, as heretofore shown, even these exceptions must have paid their way, although school buses may not have. The Eastman Report strongly hints that all classes may have paid their way in 1937. In the period 1933 and 1937 the report shows over $283,895,000 collected from motorists was diverted from highway uses to other government uses. In the period 1931-1932 it found $178,000,000 was diverted.

The Eastman Report includes, in the annual costs of highways, items estimated and which have never been paid for in any form. Had the actual expenditures been used, the amount by which the taxes paid by vehicle owners would have exceeded the true annual costs would have been startlingly larger than the bone-dry $385,360,000 shown by the report.

The report definitely disagrees with railroad contentions that better roads have been built solely or even largely to accommodate heavy truck and bus travel, and shows that no such a theory ought to have been used to impose heavier taxes on motor vehicles. The report also slays the ghost of double taxation sought to be imposed and, in fact, imposed on motorists through tax rates which included an amount for the theoretical payment of taxes on public roads by the state.

The Report found that 80 per cent of the annual cost of state highways, 23 per cent of the cost of county and local roads, and an amount varying from 12 to 28.5 per cent in 1932 should have been borne by motorized highways users. These are considerably less than the States of Illinois and Missouri use as a basis of taxation and is decidedly less than the railroads claim should be imposed on their competitors.

The Eastman Report found that the Government had spent at least $2,139,000,000 for Rivers and Harbors Improvement work. It also found the airways were aided by the Government through excess payments for handling mail, from July, 1930, to July, 1938. It found that the Government spent $55,777,000 from 1926 to 1938 in providing airways, airway services and airports. Other air aids totaled $56,500,000. The report found that about one acre out of ten of all the land within Continental America had been granted to the rail lines as subsidies during their early construction. It also found that the Panama Canal was self-sustaining. It said, in effect, that parallel rail lines had so reduced rates as to virtually stifle waterway competition. The report favors collection of tolls.

And it concluded that—

> "It may be conceded that the introduction of more efficient or economical means of transportation ought not to be prevented to save existing carriers from injury, for otherwise progress would be stopped."

Exports of Aircraft and Parts

During the past eight years the United States has constantly increased its lead as an exporter of aircraft and parts. In 1932 its share of the total exports under this head by five leading producing countries was 41.8 per cent; second place was held by Great Britain with 32.0 per cent, and third by France with 16.7 per cent, the two other countries concerned being Italy (6.7 per cent) and Holland (2.8 per cent). In 1936 the percentages of these countries were as follows: U. S., 46.5 per cent; Great Britain, 29.4 per cent; France, 18.2 per cent; Italy, 3.1 per cent, Holland, 2.7 per cent. For 1939 figures are available only for the first eight months of the year. During this eight-months period the exports of aircraft and parts were distributed as follows: U. S., 69.2 per cent; Great Britain, 19.8 per cent; Italy, 5.6 per cent; France, 4.2 per cent; Holland, 1.2 per cent. Aircraft engines, of course, account for a considerable fraction of the total value of the exports. In the case of Great Britain the engines exported separately were valued at about 75 per cent of the complete planes exported in 1932 and about 50 per cent in 1938.

NEWS OF THE INDUSTRY

Pennsylvania Trucking Law Upheld by Supreme Court

ICC Had Attacked Act Forbidding Transport of Cars on Truck-Trailer Convoy Racks Over the Cabs of Trucks

Because it is a size and weight regulation, the Pennsylvania law forbidding the carrying of automobiles in truck-trailer convoy racks over the cabs of trucks, falls within the state's power and therefore is valid, the Supreme Court of the United States held in a decision of April 22. The Pennsylvania act had been attacked by the Interstate Commerce Commission. The commission said that if it were held constitutional it would mean a gradual whittling away of the commission's safety requirements under the Federal Motor Carrier Act, give a diversity to and foster state regulations governing the operations of the trucking industry, and burden operations in interstate commerce of hundreds of thousands of vehicles.

Meeting the attack that the state law conflicts with the Federal law, the decision, written by Justice Stone, said that the latter act "imposes no duty and confers no authority" on the Interstate Commerce Commission to regulate the size and weight of vehicles.

The decision may have far-reaching effects respecting federal regulation of the size and weight of trucks engaged in interstate commerce. Nevertheless the commission will proceed with its extensive investigation regarding regulation of sizes and weights of common and contract carriers engaged in the transportation of passengers and common, contract and private carriers engaged in the transportation of property in interstate commerce. The matter of such regulation will be left with Congress, in view of the decision. The report on the investigation is almost completed. It will be followed by hearings, after which recommendations will be made to Congress. The court decision would make necessary amendment to the Motor Carrier Act if Federal regulation of size and weights is undertaken.

NADA Makes Seventh Annual Trade Survey

The National Automobile Dealers Association is conducting its seventh annual trade survey, 18,000 questionnaires having been sent to automobile dealers handling 85 per cent of the nation's business in motor car retailing.

The purpose of this activity has been to establish definite factual evidence that would show the actual earnings made by automobile retailers, costs of doing business, and the various factors that determine the extent of profit and loss.

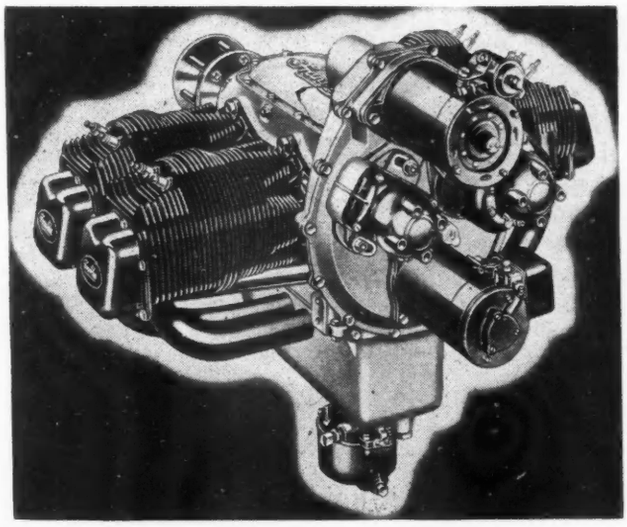
Willard F. Rockwell

. . . who has been elected chairman of the board, Timken Detroit Axle Co., succeeding Col. H. W. Alden, resigned. Col. Alden will continue as a director in charge of engineering. Walter F. Rockwell has been made president.

1940 Safety Trophy Awarded to Plymouth

Special award for highest ranking in the automobile industry on safety design was presented to Plymouth Division of Chrysler Corp., at the eleventh annual eastern Safety Conference in New York City on April 18. More than 5000 accident prevention experts from 30 different states attended this year's annual sessions, conducted by the the Greater New York Safety Council.

The 1940 Trophy for safest auto design was formally presented to D. S. Eddins, Plymouth's president, by the publication *Safety Engineering* which made the comparative study of present model cars.



Franklin

Rear view of new 80 hp. aircraft engine, model 4AC-176, built by Aircooled Motors Corp., Syracuse, N.Y., showing Electric Auto-Lite starter and generator assembly. Without starter and generator assembly the unit weighs 170 lb.; with, 198 lb.

Work Starts on New Chrysler Addition

Construction has begun on a new 78,000 sq. ft. building at the Chrysler Corp. Highland Park plant. The new building will replace two older buildings. Outstanding among the construction features is the almost entire absence of interior columns, resulting in a maximum of usable floor space.

NEWS

International

He Joined The Parade

Edsel Ford, president of the Ford Motor Co., pictured as he testified before the Monopoly Committee in Washington, D. C. "It is believed," he said, "that the effect of technological change has been and will be to increase the volume of production, to increase the number of workmen and to increase the volume of wages paid." (See story on this page.)

TNEC Hears More About U. S. Men and Machines

Edsel Ford and R. J. Thomas Express Widely Divergent Views on the Effects of Technological Developments

Joining the parade of research engineers and other industrial leaders, Edsel Ford, president of the Ford Motor Co., appeared before the Temporary National Economic Committee at Washington on April 10 and recited the benefits of technological developments on employment and the nation's economy. On the day preceding Mr. Ford's appearance, Charles F. Kettering, vice-president of General Motors Corp., in charge of research who, as stated in AUTOMOTIVE INDUSTRIES of April 15, said that contrary to claims that too many inventions have produced unemployment, there aren't enough new things to provide sufficient jobs for all of the people who want work. Mr. Ford said his company was interested in producing a lower priced car but is restrained from doing so by large scale unemployment and the farm depression.

From R. J. Thomas, president of CIO's UAW, who followed Mr. Ford as a witness, came the statement that his organization was not interested in hindering technological improvements but only in obtaining a greater share of the benefits for labor. Quoting profits of General Motors and Ford, the labor spokesman implied that hours could be reduced, employes added and wages increased by diverting funds from company profits to workers. As one method directed to this end, Mr. Thomas said that his union is attempting to obtain a six-hour, five-day week.

Mr. Ford said that employment by the Ford company during the past six years has not been affected adversely by any possible technological reaction, but that instead, even with improved working facilities, has steadily employed more men, paid out more wages and purchased more materials. Accompanying Mr. Ford on the stand were R. H. McCarroll, chemical and metallurgical engineer and H. L. Moekle, auditor, of the Ford company.

$100,000 Probe of Labor Costs and Productivity

While the Temporary National Economic Committee was exploring the subject of technological advances and their effect upon labor at public hearings recently, the House passed and sent to the Senate a bill calling for a $100,000 study of productivity and labor costs in industry to be made by the Labor Department's Bureau of Labor Statistics.

Strong opposition was voiced by Representative Charles L. Gifford, Republican, of Massachusetts, who characterized the bill as "another method to bolster arguments favorable to this administration," but when called up for a vote the measure passed by a count of 307 to 14. An identical bill is pending on the Senate calendar.

Senator Joseph C. O'Mahoney, Democrat of Wyoming, chairman of the TNEC summarized Mr. Ford's testimony. As he analyzed it, the Senator said Mr. Ford made three outstanding points: First, that without modern machines and technological improvements it would be utterly impossible for the Ford Motor Co. to supply so many cars to so many people; second, that it would be impossible to use the machines without a large purchasing power; third, that the measure of purchasing power is the ability of the masses to purchase products. Asked by the Senator if these conclusions were correctly drawn from his testimony, Mr. Ford said they were.

While Mr. Ford agreed with Senator O'Mahoney regarding the economic and social benefits of technological developments the Ford executive said he could not offer any suggestions when the Senator inquired how Congress could help his company create more jobs. Mr. Ford also had previously said that he did not believe that new legislation is necessary in adjusting the labor force affected by technological change. He declared that he believed the company had been very successful in its plans for spreading work, annual income payments, wage and hour adjustments, in service training, intra-plant shifting, etc., in making the adjustment and that it will continue to improve its handling of them.

Considerable discussion was given to the possibility of Ford producing a lower-priced car so that it could be made available to a low-income group which cannot now afford to purchase a car. Coupled with the query suggestions were asked concerning the prospect of increasing the purchasing power of this group.

Mr. Ford said the company could manufacture a car selling for $500 or less, if "we could have a market of 1,000,000 cars" but that this would have "a very drastic effect upon the used car market." He stated that such a car would have more power and operate much better than the old model "T," which his father pioneered.

Concerning the effects of patent rights on technological developments, it was stated that when patent rights are held by those who make no effort to put them to good use, they retard development. However, it was explained, when considering modification of patent rights, there must not be overlooked the incentive given to thought and work and development by the possible compensating returns from proper use of patent rights.

The effect of technological change, it was declared, has been and will be to increase the volume of production, to increase the number of workmen and to increase the volume of wages paid. To support this statement the committee was told that the amount of payroll and purchases for Ford model T with its about 5000 parts in 1926 was $454.42 while the comparable figure for the model A with its about 6000 parts in 1929 was $526.84 while for the model

V-8 with its about 16,000 parts in 1939 was $683.23.

Records were said to show that during the past six years, both labor and the purchases per automotive unit produced by the Ford company have steadily and substantially increased.

Figures for 12-month periods were submitted to show that there has been a progressive increase in both the total hours of labor and in the average hours per automotive unit produced by the Ford company. Figures were also given to show that along with the increase in labor hour and labor cost per unit, the amount of purchases per unit rose.

Regarding type of ownership, it was said that results may be much more quickly accomplished where efficient

(*Turn to page* 438, *please*)

U. S. Rubber Consumption Up One Per Cent in March

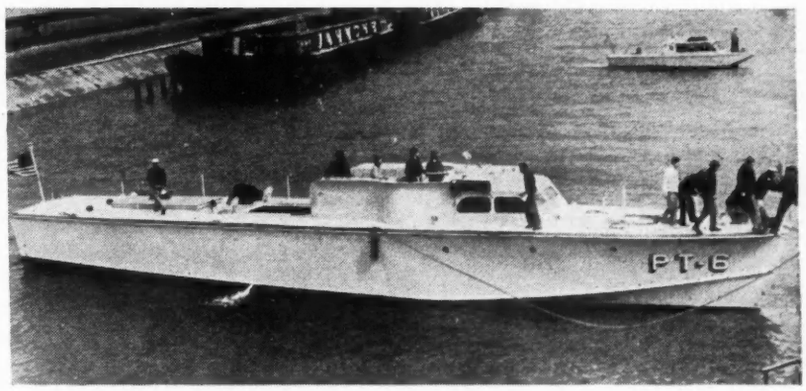
Rubber manufacturers in the United States consumed 50,192 long tons of crude rubber during the month of March, according to statistics released by the Rubber Manufacturers Association, Inc. This represents an increase of less than one per cent over the February consumption of 49,832 long tons and is but slightly above March, 1939, when 50,165 long tons were consumed.

Gross imports for March as reported by the Department of Commerce, were 59,258 long tons, representing an increase of 37.5 per cent above the February figure of 43,088 long tons and 52 per cent over the imports for March, 1939, which amounted to 39,989 long tons.

Total domestic stocks are estimated by the association as of the end of March to be 149,678 long tons, an increase of less than one per cent over the stocks on hand at the end of February, which were 148,776 long tons, but 27.3 per cent under the stocks of 205,936 long tons on hand at the end of March, 1939.

Crude rubber afloat to United States ports on March 30 is estimated to have been 113,619 long tons, which compares with 112,257 long tons reported afloat as of the end of February, and 55,981 long tons afloat March 30, 1939.

Reclaimed rubber consumption for March is estimated at 17,560 long tons, production of 18,266 long tons, and stocks on hand March 30, 1940, at 26,221 long tons.



Acme

$218,000 Worth of Speed

The nation's newest type torpedo boat, the PT-6, shown before making a test run for naval experts on Lake Pontchartrain, La. Because of the newness of its engines, no attempt was made to reach the maximum speed believed to be about 60 m.p.h. This was the first boat to be launched under the $5,000,000 building program authorized by Congress last year to perfect speedy craft capable of challenging an invading fleet by use of torpedos launched at high speed. Cost of this boat was $218,000.

What Will They Do In France When War Ends?

French Automotive Engineers Now Seeking Answer to Problem of How to Avoid Industrial Evils of 1919

French automotive engineers have tackled the problem of preparing the industry for after-war conditions. In opening the campaign, Pierre Prevost, past president of the S.I.A., declared that legislation and the relative value of currencies would be important but unknown factors. Whatever happened, it was certain that economy of production, operation and maintenance would be of primary consideration.

When war ended the country would find itself with enlarged factories, immense staffs and no production program, unless this problem was tackled now. This was the situation in 1919 when, for lack of a program, manufacturers had to restart production on 1914 models. To avoid this disastrous situation, 5 to 10 per cent of the nation's experimental engineers should be set aside for the preparation of post-war models.

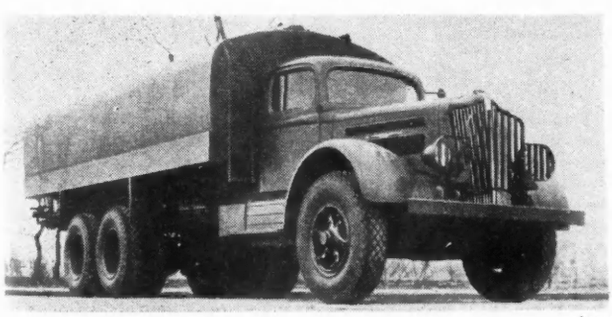
With a view to economy, weight reduction was of first importance. Prevost suggested the production of a popular, light, four-passenger car, which might be of the central backbone type, with a twin air-cooled engine in the rear fork, independent suspension all around and a flexibly mounted body. Such a car should weigh about 1500 lb. There undoubtedly would be a big market for a cheap two-passenger car—built to carry two persons only.

Maurice Goudard (President, Solex Co.) predicted that the end of the war would find France with immensely increased supplies of aluminum, duralumin, magnesium and special steels, at present monopolized by the aviation industry, and that these light alloys would become commercial possibilities for the automobile industry.

The maintenance of passenger cars could be accomplished most economically by limiting garages to more or less superficial work and establishing specialized shops throughout the country for the complete conditioning of components. It was anomalous that the highest degree of precision should be sought in the factories and that the operators in many repair shops should not know how to read precision instruments.

For truck service every encouragement should be given to the Diesel which, despite its higher initial cost, had proved itself to be more economical than the gasoline engine over long periods of service. Compressed gases of various kinds offered possibilities and the use of the electric should be developed. Suction gas engines were scored as heavy, cumbersome, and cer-

(*Turn to page* 437, *please*)



Acme

For France

Designed to operate successfully over war-torn terrain with approximately 15 tons of gasoline in its 18,000 liter tank, this White truck is one of a fleet ordered by the French Government and scheduled for delivery by June 1.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES A leading manufacturer reports an operating rate of 72.7 per cent and a record backlog of business. Sales in the East are reported to be running slightly ahead of this time last year, with several large orders in the offing.

TRUCKS A general improvement in business is noted. The increase appears to be in the neighborhood of 20 per cent as compared with 1939. Outlook for domestic trade seems to be much better than it did a year ago.

TRACTORS Reports from several of the largest concerns in the field show an increase of approximately 15 per cent over last year. While the war in Europe clouds the outlook somewhat, the domestic situation is good. One manufacturer reports his exports at about 10 per cent of total.

AUTOMOBILES April output estimated at 450,000 cars and trucks, almost 100,000 units ahead of April, 1939. Production for the first four months estimated at 1,760,000 for the United States and Canada; 24 per cent ahead of similar period a year ago.

MARINE ENGINES Sales are said to be excellent. Production of heavier marine units, particularly Diesels, in full swing.

AIRCRAFT ENGINES Production still at high levels, with backlogs showing gains.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

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Boost in Steel Prices Goes Into Effect May 1

Surprise Announcement by the Leading Producer in Effect Abrogates $4 per Ton Reduction Made April 12

Taking the steel market completely by surprise, the leading producer under date of April 24 announced a new schedule of prices, which in effect abrogates the $4 per ton reduction made in sheet and strip steel prices on April 12. The new prices become effective on May 1 and are to apply on sales for shipment up to and including Sept. 30.

There was considerable confusion in the trade as to the immediate effect of the price changes. In some quarters it was thought that the five business days remaining of the lower price period would bring out considerable tonnage commitments from automobile manufacturers. Blanket orders, it was thought in some quarters, would be acceptable to steel sellers; specifications to follow when 1941 model sizes were finally determined. Elsewhere the belief prevailed that the time was too short and that there would be no deviation by automobile manufacturers from their rule not to contract for steel until they know what their needs will be. Usually third quarter prices are hardly ever announced before June 1, and the naming of prices for a five month period is unprecedented in the steel market.

In the light of the leading producer's latest announcement, it is now thought that a Wall Street prediction that the lower sheet and strip steel prices would be rescinded shortly, was really intended as a warning to buyers and originated in authoritative steel quarters. Steel company salesmen met with little success when they sought to have customers anticipate their requirements because of this report. Ford Motor Company, it is learned, covered its normal May requirements of flat rolled steel at the lower prices announced on April 12. The next few days should reveal whether automobile manufacturers have been accorded price protection on steel commitments beyond those for current and nearby assemblies. The rate of mill operations dipped during the week ended April 27 to 60 per cent of ingot capacity, the lowest of the year, and strenuous efforts are being made to arrest the decline. The smoking out of as much automotive business as possible heads this program.—W. C. H.

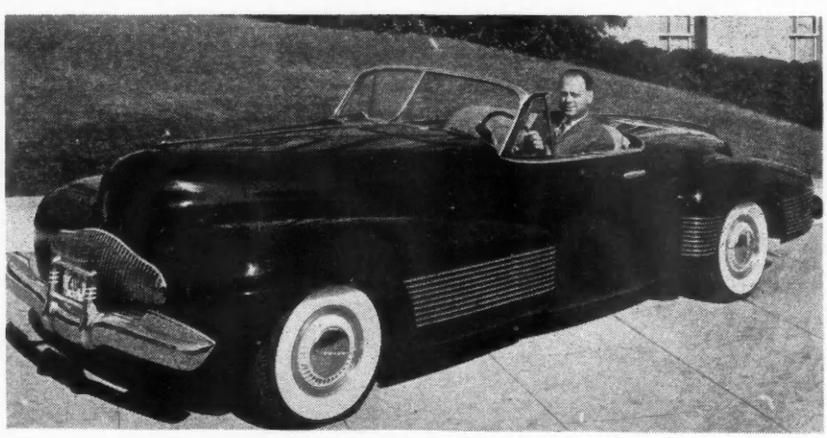
Hugh A. Gillies

Hugh A. Gillies, 58, vice-president in charge of sales of the American Brakeblok Division of the American Brake Shoe and Foundry Co., died in New York on April 23 of a cerebral hemorrhage.

Two Injunctions Stop Compensation

Two injunctions halted the payment of $1,892,000 in benefits to 23,000 Chrysler workers who were made idle by last fall's 54-day strike after the Appeal Board of the Michigan Unemployment Compensation Commission had upheld the ruling of referee Charles Rubinoff and even liberalized his awards to some extent.

Judge Leland W. Carr, in the Ingham County Circuit Court at Lansing, issued a writ of certiorari, April 24, calling for a review of the case on petition by the Chrysler Corp. which cited 23 alleged errors in the Appeal Board ruling. He enjoined payment from the State unemployment compensation fund until May 6. In Wayne County Circuit Court at Detroit, Judge Arthur Webster granted a temporary injunction and show-cause order returnable, May 3, on the petition of 11 taxpayer



The 194? Buick

New ideas in streamlining and mechanical contrivances were built into this experimental Buick model conceived by General Motors stylists and Buick engineers. Disappearing headlights, flush-type door handles, completely concealed automatic top, electrically operated window regulators, smaller wheels with airplane-type air cooled brakes, a new bumper guard and license plate combination and other innovations are incorporated in this car. It has a 123-in. wheelbase and is powered by a Buick series 50 Super, 107 hp., valve-in-head straight eight engine.

60% Grade

Specially designed reconnaissance vehicles included in a recent U. S. Army order with Chrysler Corp. for 10,786 Dodge trucks must be able to go up a 60 per cent grade, similar to the ramp shown here, with a full load and make 45 m.p.h. on the level.

members of the Michigan Manufacturers Association. The Michigan Unemployment Compensation Act provides that benefits flow immediately upon a second affirmation of claims such as that made by the Appeal Board.

The appeal board, composed of Calvin N. Smith, chairman, Charles E. Lougheed and Charles A. Roxborough, upheld Rubinoff's contention that no labor dispute existed in the De Soto, Plymouth, Amplex, Chrysler-Highland Park, Kercheval and Jefferson plants. The board also affirmed Rubinoff's decision that a labor dispute existed in the Dodge main, forge and truck .plants. The word "establishment" was applied to each of the individual plants of the corporation.

BOOKS . . . .

AEROSPHERE 1939. *Including World's Aircraft Engines with Aircraft Directory. Edited by Glenn D. Angle. Published by Aircraft Publications, New York, N. Y.*

This rather ambitious publication is intended as an annual of reference for those engaged in the aircraft industry. It is divided into four parts. The first and largest section contains illustrations and more or less detailed descriptions of practically all aircraft engines produced in all parts of the world since the beginning of human flight. In the second section all current types of aircraft are illustrated and briefly described. The third section contains general information and statistics of various kinds that may interest those engaged in aircraft production and operation, while the fourth section is a directory of the aircraft industries of the world. There are two divisions for each country, the first being an alphabetical list of firms and individuals with address, the names of officials and executives in the case of corporations, branch offices, and products; the second division lists the firm name under each article which it is known to produce, and the product headings are arranged alphabetically.

The foregoing will give a general idea of the contents of the work, which contains 1420 pages of the size of those of AUTOMOTIVE INDUSTRIES and weighs more than 11 lb. It is printed on coated paper and is a very creditable production from the typographical point of view, which is particularly noteworthy in view of the fact that original illustrations available of some of the older engines and some of those that never passed the experimental stage are rather poor in most cases.

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, *M. W. Bourdon.*

Under a new system of rationing, superseding a direct licensing system in force since the outbreak of war, the British automobile industry will have a predetermined quantity of steel periodically allocated to it by the Ministry of Supply, and the Society of Motor Manufacturers and Traders, acting through a special committee, will decide what tonnage shall be supplied by steel manufacturers to each firm in the industry for export trade and home market requirements.

* * *

It is reported, though without official confirmation, that the Government has appointed a panel of oil experts to consider and, if feasible, to organize a scheme for collecting and reclaiming used engine oil on a national basis, in order to economize in tanker tonnage.

Passenger Car and Truck Production

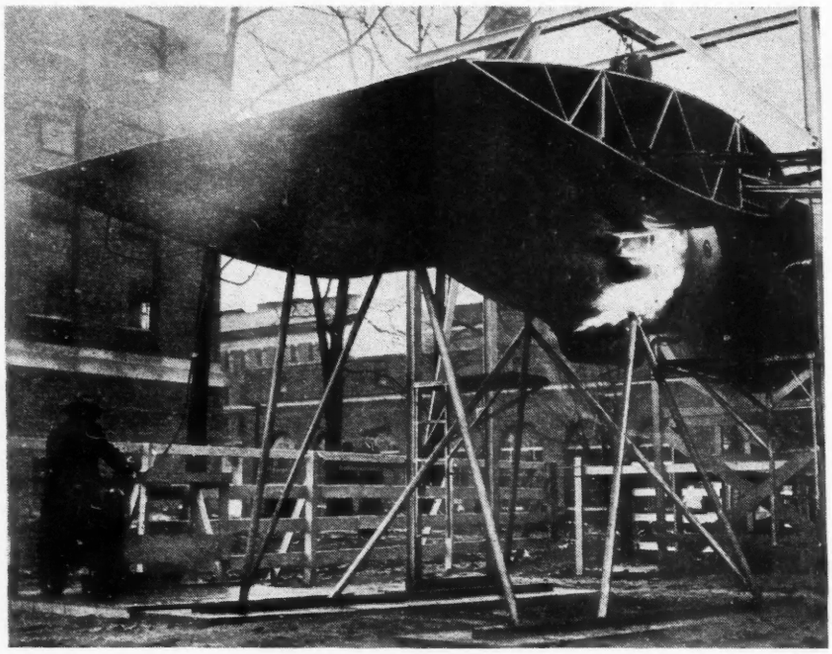
(U. S. and Canada)

	March 1940	February 1940	March 1939	THREE MONTHS 1940	THREE MONTHS 1939	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	341,634	324,555	279,148	1,014,944	765,273	+32.6
Foreign Market—U. S.	10,839	12,817	20,555	37,637	58,895	−36.1
Canada	12,025	12,779	12,689	37,383	35,007	+ 6.8
Total	364,498	350,151	312,392	1,089,964	859,175	+27.0
Trucks—U. S. and Canada						
Domestic Market—U. S.	58,650	53,960	57,503	167,656	151,222	+11.0
Foreign Market—U. S.	12,176	12,295	14,740	38,790	41,944	− 7.4
Canada	4,587	5,414	4,860	14,635	11,636	+25.9
Total	75,413	71,669	77,103	221,081	204,802	+ 8.0
Total—Domestic Market—U. S.	400,284	378,515	336,651	1,182,600	916,495	+29.0
Total—Foreign Market—U. S.	23,015	25,112	35,295	76,427	100,839	−23.6
Total—Canada	16,612	18,193	17,549	52,018	46,643	+11.7
Total—Cars and Trucks—U. S. and Canada	439,911	421,820	389,495	1,311,045	1,063,977	+23.2

Monthly Motor Vehicle Production

(U. S. and Canada)

	PASSENGER CARS 1940	PASSENGER CARS 1939	TRUCKS 1940	TRUCKS 1939	TOTAL MOTOR VEHICLES 1940	TOTAL MOTOR VEHICLES 1939
January	375,315	272,869	73,999	64,093	449,314	356,962
February	350,151	253,914	71,669	63,606	421,820	317,520
March	364,498	312,392	75,413	77,103	439,911	389,495
3 Months	1,089,964	859,175	221,081	204,802	1,311,045	1,063,977
April	.....	286,200	.....	68,066	.....	354,266
May	.....	249,455	.....	63,793	.....	313,248
June	.....	257,283	.....	66,964	.....	324,253
July	.....	155,850	.....	62,644	.....	218,494
August	.....	62,475	.....	40,868	.....	103,343
September	.....	165,119	.....	27,559	.....	192,678
October	.....	259,610	.....	65,078	.....	324,688
November	.....	295,134	.....	73,407	.....	368,541
December	.....	385,295	.....	83,825	.....	469,120
Total	.....	2,975,602	.....	757,006	.....	3,732,608



Acme

C.A.A. Aircraft Fire Test

To determine means of safeguarding aircraft from dangers associated with power plant fires, the Civil Aeronautics Authority demonstrated its power plant fire tests recently at the National Bureau of Standards. With a wind tunnel in operation to simulate flight conditions a fire was started in the vicinity of engine cylinders. Two fire detectors placed on cowling just aft of engine cylinders indicated the presence of fire instantly by closing an electric circuit and lighting red bulb in control room. Carbon dioxide gas was applied to extinguish the fire. The gas in liquid form under high pressure was led to the engine through copper tubing and distributed by two perforated rings around engine. Time of gas discharge was approximately five seconds to extinguish fire which had been burning 20 seconds.

Richberg Will Continue As NADA Special Counsel

Retention of Donald R. Richberg as special counsel in connection with its factory-dealer relations activities has been announced by the National Automobile Dealers Association.

Mr. Richberg, a former NRA Administrator, appeared for NADA in conjunction with Charles W. Bishop, general counsel of the Association, at the hearing on March 20, before the Federal Trade Commission on the proposed Trade Practice Rules for the automobile industry.

Firestone Now Producing Buna – Synthetic Rubber

Regular production of buna, a synthetic rubber already tested and widely used abroad, has started in this country. The Firestone Tire & Rubber Co. has just consummated the necessary licensing agreements with the Standard Oil Development Co. (New Jersey), United States patent holders.

Of the various types of buna produced, only two are under consideration for immediate production by Firestone. Buna N, now also called perbunan, will receive the major attention because it lends itself to many mechanical rubber goods. Buna S, used abroad in automobile tires, is expected to play a minor role in tire production in this country because of its prohibitive cost.

Of the materials used in the manufacture of both types of buna approximately 80 per cent is butadiene, a product of the petroleum cracking processes that have been more recently developed to improve aviation gasoline. Normally it is a gas, but in the process of making buna, it is handled under pressure to keep it in a clear watery liquid state.

Coal tar derivatives are added, such as styrene in the making of Buna S. In the case of Buna N, acrylonitrile is combined with the butadiene. Both of these substances look like clear water and have an agreeable though somewhat pungent odor. All these ingredients are standard industrial products regularly produced in ample quantity in the United States.

The ingredients are first emulsified with a modern soap. Under application of heat and pressure, copolymerization is effected. Essentially, this is the joining of one acrylonitrile and two butadiene molecules to form a complex rubber molecule. The product looks like milk. This is an artificial latex, so near in appearance to the natural rubber latex that even research engineers cannot tell them apart without chemical tests. Buna will be coagulated, compounded and calendered in the same way as natural latex.

Safety Foundation Moves to Washington

Headquarters of the Automotive Safety Foundation have been moved from New York City to the Tower Building, Washington, D. C., according to Norman Damon, director.

Kuhn Loeb & Co. Buys Interest in Willys

The New York firm of Kuhn Loeb & Co. has purchased a substantial interest in Empire Securities Corp. which controls the Willys-Overland company. Expressing himself as highly pleased with the prospect of close association with Elisha Walker, senior partner of Kuhn Loeb & Co., and the other members of the financial group participating

New Truck Registrations

	February 1940	January 1940	February 1939	TWO MONTHS 1940	TWO MONTHS 1939	Per Cent Change, 2 Months 1940 over 1939	Per Cent of Total Two Months 1940	Per Cent of Total Two Months 1939
Chevrolet	14,145	15,997	12,007	30,142	25,622	+ 17.6	34.66	35.68
Ford	12,092	13,282	9,224	25,374	19,412	+ 30.4	29.17	27.03
International	5,009	5,538	4,284	10,547	8,993	+ 17.2	12.12	12.52
Dodge	4,341	4,345	3,821	8,686	7,823	+ 11.0	9.99	10.89
G. M. C.	2,724	3,142	2,218	5,866	4,602	+ 27.8	6.74	6.41
Plymouth	767	718	510	1,485	1,017	+ 46.2	1.71	1.42
Mack	425	572	398	997	880	+ 13.2	1.15	1.23
Diamond T	425	536	308	961	686	+ 40.1	1.10	.95
White	371	422	255	793	588	+ 35.0	.91	.82
Willys-Overland	182	173	97	355	185	+ 92.0	.41	.26
Divco	180	143	148	323	223	+ 45.0	.37	.31
Federal	113	153	79	266	164	+ 62.0	.31	.23
Autocar	94	143	134	237	277	− 14.4	.27	.38
Brockway	92	117	98	209	225	− 7.0	.24	.31
Studebaker	101	85	143	186	312	− 40.4	.21	.43
Hudson	60	56	44	116	91	+ 27.5	.13	.13
Bantam	48	38	38	86	71	+ 21.0	.10	.10
F. W. D.	27	27	15	54	38	+ 42.1	.06	.05
Sterling	31	22	29	53	54	− 1.8	.06	.07
Indiana	9	12	20	21	35	− 40.0	.02	.05
Reo	4	11	159	15	327	− 4.6	.02	.46
Miscellaneous	96	118	73	214	192	+ 11.5	.25	.27
Total	41,336	45,650	34,102	86,986	71,817	+ 21.0	100.00	100.00

New Car Registrations and Estimated Dollar Volume by Retail Price Classes*

	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	February				Two Months				February				Two Months			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	122,326	93,273	54.47	56.59	264,082	207,245	54.47	56.32	$93,500,000	$68,200,000	48.11	48.78	$201,800,000	$151,600,000	48.01	48.43
Others under $1,000	72,255	56,073	32.17	34.02	155,540	125,093	32.09	33.99	65,400,000	51,800,000	33.65	37.06	141,000,000	115,500,000	33.55	36.90
$1,001 to $1,500	28,317	12,740	12.61	7.73	61,114	30,551	12.61	8.30	32,000,000	14,800,000	16.47	10.59	69,300,000	36,000,000	16.49	11.51
$1,501 to $2,000	1,044	1,808	.46	1.10	2,433	2,927	.51	.80	1,800,000	2,800,000	.93	2.00	4,300,000	4,600,000	1.02	1.47
$2,001 to $3,000	657	850	.29	.52	1,556	2,015	.32	.55	1,600,000	1,900,000	.82	1.36	3,800,000	4,600,000	.90	1.47
$3,001 and over	8	64	.....	.04	24	152	.....	.04	40,000	300,000	.02	.21	120,000	700,000	.03	.22
Total	224,607	164,808	100.00	100.00	484,809	367,983	100.00	100.00	$194,340,000	$139,800,000	100.00	100.00	$420,320,000	$313,000,000	100.00	100.00
Miscellaneous	18	134	.....	.....	32	171	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	224,625	164,942	.....	.....	484,841	368,154	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

in the deal, J. W. Frazer, president of Willys-Overland Motors, Inc., said: "The participation of Mr. Walker and his associates in the affairs of Willys-Overland will not affect the company's operation or personnel, but the acquisition of such able partners will definitely assist us in the successful working out of our plans for the future."

Rim Inspections Up 11% in March

Rims inspected and approved by the Tire & Rim Association in March totaled 1,918,041. This is an increase of approximately 11 per cent above the figure reported for March, 1939. During the first three months of 1940 the number of rims inspected and approved totaled 5,932,338, an increase of slightly more than 21 per cent as compared with the similar period of 1939.

Flanders Will Address SAE Production Group

Ralph Flanders, president of Jones & Lamson Machine Co., is to be principal speaker at the banquet of the National Production Meeting of the Society of Automotive Engineers, to be held at the Hotel Bond, Hartford, Conn., May 7 and 8. His topic will be "Industry and the Job Problem."

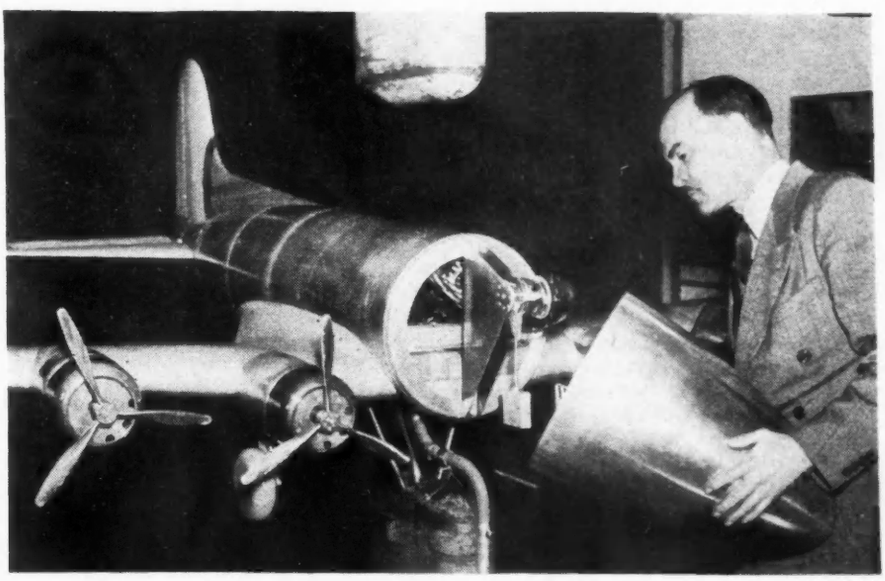
At the opening session, Tuesday morning, May 7, H. L. Moir, The Pure Oil Co., and Prof. O. W. Boston, University of Michigan, will reveal results of a "New Study of Cutting-Fluid Recommendations." At the same session L. S. Martz, Micromatic Hone Corp., will show data on "Producing Specified Finishes by Honing." Tuesday afternoon will be devoted to an inspection trip through the new plant of the Pratt & Whitney Division of Niles-Bement-Pond Co.

Wednesday morning will be given entirely to a paper by Val Cronstedt, Pratt & Whitney Aircraft, on "Special Problems in the Production of Aircraft Engines." In the afternoon, "A New Method of Testing and Grading Fine Abrasives," will be the topic of E. L. Hemingway, Foster Machine Co. The second presentation will be "Control of Surface Finish in Machine Shop Practice," by R. F. Gagg, Wright Aeronautical Corp.

The banquet, which is to be held Tuesday evening, will be conducted by Warren F. Teigeler, Fafnir Bearing Co., chairman of the SAE Southern New England Section. Arthur Nutt, vice-president of engineering, Wright Aeronautical Corp., and president of the Society will share the program with Mr. Flanders. Toastmaster for the affair will be E. R. Smith, vice-president and general manager, Seneca Falls Machine Co., who is vice-president of the Society representing its production activity.

Packard Electric Expands Facilities

The Packard Electric Division of General Motors Corp., Warren, Ohio, is undertaking an immediate building expansion program that will add 75,000 square feet of floor space and include construction of a two-story personnel building and a one-story manufacturing building, demolition of an old two-story office building, modernization of the boiler house and relocation of the shipping room and docks.



Globe

For Wind Tunnel Use Only

Having removed the spun-dural nose-section to reveal interior mechanisms, E. T. Allen, Boeing director of flight and research, examines the wind tunnel model of the new Boeing 307 Stratoliner. One of the most complete models ever built, at a cost of $16,000, it is one-tenth the size of the real plane. The four engine nacelles each house a five h.p. electric motor and all flight controls may be operated from a remote point.

Negotiations Between GM And UAW-CIO to Start Soon

Corporation Awaiting a Formal Certification by NLRB of CIO's Decisive Election Victory Over AFL

Negotiations between General Motors Corporation and the UAW-CIO were expected to get underway shortly as a consequence of the union's decisive victory in the National Labor Relations Board election held April 17 in 59 GM plants throughout the country. The UAW-CIO won exclusive bargaining rights in 48 plants and polled 61 per cent of the total vote. The corporation was awaiting formal certification of the election results from the NLRB before opening conferences with union officials.

Walter P. Reuther, director of the GM department of the UAW-CIO outlined the aims of the union in a recent radio address, asserting "We will negotiate for a general wage increase, for a shop steward system, for improved seniority provisions, for vacations with pay and for a joint adjustment on disputed production standards."

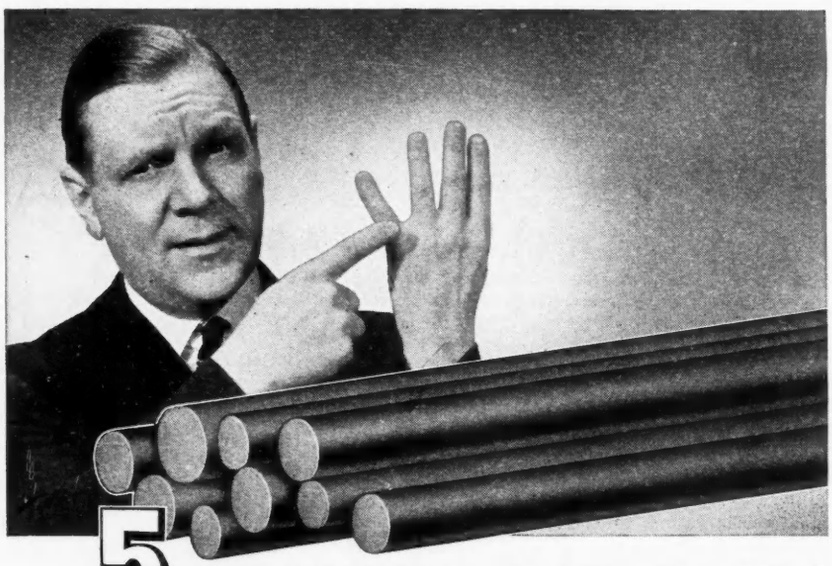
The union intends to negotiate these points "in an orderly and constructive spirit," Reuther added. However, he declared the long range goal of the union is to eliminate machine-made unemployment by obtaining a 30-hour week with 40-hour pay and with a guaranteed annual wage. General Motors reported average annual earnings of hourly workers to be $1,503 during 1939.

The contract between GM and UAW-CIO was originally ratified March 14, 1937, following a six week strike that tied up most GM plants. It is a continuing contract, with no expiration date, although some changes have been made from time to time. Amendments were made last Summer after a strike of tool and die makers. In the impending negotiations, the UAW-CIO has filed the requisite 60-day notice of intention to amend the contract.

In the NLRB election of April 17, 94 per cent, or 128,957 workers, cast ballots—84,024 for the UAW-CIO, 25,-911 for the UAW-AFL, and 13,919 for neither union. The 48 plants won by the UAW-CIO employ more than 120,000 workers, while the five plants won by the UAW-AFL had 5693 eligible voters. The CIO victory ended dual bargaining committees in eight plants. The five plants won by the UAW-AFL, all outside of Michigan, were the Chevrolet and Fisher plants in Norwood, Ohio, the Chevrolet and Fisher plants in Kansas City and the New Departure plant in Meriden, Conn. However, the two plants in Norwood had voted prior to the election to join the union which captured a majority of the GM plants, so the AFL may lose them.

The Detroit Diesel engine division voted for the Mechanics Educational Society of America, an independent union, the Harrison Radiator plant at Buffalo voted non-union, while the disposition of several challenged ballots made the outcome doubtful in the Chevrolet experimental plant at Detroit. Run-off elections will be required at three plants where no group received a clear majority—Fisher No. 40 garage at Detroit, Delco-Remy at Anderson, Ind., and Chevrolet at Baltimore. The non-union group led at Anderson, while UAW-CIO was on top in the other two.

In craft elections at pattern departments of nine plants, the UAW-CIO won five, where the department will become part of the plant industrial unit. The pattern makers league of North America, an AFL union, won four craft polls. The die sinkers local of the International Association of Machinists, an AFL union, won in the Flint Buick plant, while a run-off election will be required in the Detroit Chevrolet forge plant, where the AFL die union led the CIO, 78-72.



5 REASONS FOR USING

Ryerson Certified Steels

1 **Every pound of steel in Ryerson stock is certified, prime quality. No seconds are ever carried. Ryerson has built up complete stocks of these better steels in every classification — steels made to narrow, close-range specifications that assure better working qualities.**

2 **Ryerson Certified Steels cut labor costs. These better steels are free from hard or soft spots and can be depended upon for uniform working and forming qualities. Spoilage and breakage are reduced, proving Ryerson Certified Steels are superior for close-tolerance work, automatic equipment, and production line applications.**

3 **Ryerson stocks are complete and diversified. You save time, trouble and money by concentrating all steel requirements with this one dependable source of supply. Stocks include everything from structurals to stainless—from mechanical tubing to foundation bolts.**

4 **The special quality control plan on Ryerson Certified Alloy Steels assures uniform heat treatment response and eliminates testing, experimenting and reheating. Complete data and exact heat treating characteristics of each bar are sent with the steel.**

5 **Ryerson Certified Steels cost no more. You pay no premium for the uniform high quality of Ryerson products. If you do not have the Ryerson Stock List—the guide to Immediate Steel—we will gladly send a copy on request.**

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

What's Your Idea?

The proposal recently advanced by Wilbur Shaw, top-flight racing driver, that pari-mutuel betting be introduced into automobile racing drew a barrage of brickbats from the Contest Board of the American Automobile Association.

"Shaw's idea is that pari-mutuel betting would bring a renewed interest in racing and bigger purses for the drivers," said Ted Allen, secretary of the A.A.A. Contest Board governing all recognized racing and speed record trials. "The fact is that betting would do automobile racing more harm than good."

February Automobile Financing Off 0.2%

Dollar volume of retail automobile financing for February 1940 amounted to $110,371,421, according to the Bureau of the Census, Department of Commerce. This is a decrease of 0.2 per cent as compared with January 1940; an increase of 34.7 per cent as compared with February 1939; and an increase of 58.6 per cent as compared with February 1938. The volume of wholesale financing for February 1940 is reported by the Bureau at $187,466,157, a decrease of 0.9 per cent compared with January 1940; an increase of 46.0 per cent as compared with February 1939; and an increase of 156.3 per cent as compared with February 1938.

In France

(*Continued from page* 431)

tain to become uneconomical as soon as the Government shifted the fuel tax to wood and charcoal. Baron Petiet, president of the National Automobile Federation, said that if it became necessary to use wood it was more economical to burn it under a boiler than try to convert it into a gas for an internal combustion engine.

Thousands of cross-country vehicles, most of them new and improved types, are now being produced by French factories for military use. Maurice Goudard stressed the importance of being able to turn these onto the land as soon as the war was over.

French automobile exports are practically dead at the present time and the output of automobiles for civilian use is probably not more than 10 per cent of that of normal times. No truck of more than 3000 lb. load capacity can be sold either by the manufacturer or the importer except with a Government permit. American trucks — Dodge, Studebaker and White—are now coming through, in addition to quantities of motorcycles. The arrival of American vehicles is making it possible to release quantities of French trucks which were requisitioned in September, and these are being sold at auction, with preferential bids for former owners.

These trucks were mostly in poor condition when taken into the army and are now in need of extensive repairs. The S.I.A. (Automotive Engineers) always has denounced the policy of restricting the truck industry in order to bolster up the State-owned railways. This policy led to an important shortage of suitable army trucks last September and has now made it necessary to import American trucks which could have been produced in France.

Further gasoline restrictions have reduced the allowance of gasoline for private car owners to 13 gal. per month, the size of the car not being taken into consideration. Owners who are engaged on military and public duties receive special consideration. No gasoline substitutes have been adopted for passenger cars, but there is a limited use of trucks with suction gas plants, usually burning charcoal. It is certain that the charcoal burner is only a war-time substitute and that under normal conditions there will be a return to liquid fuel. A war-time decree states that gasoline retailers must stock some substitute fuel, but as the distribution of charcoal is in an embryonic stage, this law is a dead letter.

What DO YOU EXPECT OF A THERMOSTAT?
ACCURACY
SENSITIVENESS
SURE-ACTION
NON-FATIGUING BI-METAL
DEPENDABILITY
● Because Dole Thermostats provide all these vital qualities month after month . . . under varying road, load and weather conditions . . . they are helping automotive engineers—achieve new standards of performance. By controlling motor temperatures they assure operating economies and thus protect car builders' reputations . . . help sell more cars. Write our engineering staff about your particular requirements. THE DOLE VALVE COMPANY, 1901-1941 Carroll Ave., Chicago, Ill.
Detroit Office: General Motors Bldg.
DOLE Thermostats & Thermostatic Bi-Metal

PUBLICATIONS

A general guide to the uses and properties of **nickel and high nickel alloys** is incorporated in an illustrated booklet entitled "Seven Minutes with Seven Metals" which has been published by the International Nickel Co., New York City.*

Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturers of conveying, material handling and screening equipment, present data and drawings covering various types of **material handling installations** in volume 185 of "The Labor Saver."*

In a catalog on **transmission belting** issued by Graton & Knight Co., Worcester, Mass., information is condensed, tabulated and so arranged that it is convenient to select the proper belt for each type of drive requirement. Information on belt dressings and cements is included; also, suggestions on belting installation and maintenance and instructions on how to select the proper belt for the drive.*

The Young Radiator Co., Racine, Wis., has issued a bulletin entitled "Time Moves On At Young's" which presents graphically the **service record** of its 357 employes.*

Silver nickel contacts are discussed in a leaflet prepared by the Gibson Electric Co., Pittsburgh, Pa.*

"Twenty-five Years of Service, 1914-1939" is the title of a brochure brought out recently by the **Engineering Foundation,** Engineering Societies Building, 29 W. Thirty-Ninth St., New York.

Detailed recommendations on how to machine and fabricate "Vinylite" resins by common woodworking and metalworking methods are given in a booklet, **"Fabricating Processes for 'Vinylite' Resins,"** published by the Carbide and Carbon Chemicals Corp.*

The 1940 "Dual Wheel Catalog" issued by the Budd Wheel Co., Detroit, Mich., contains complete information on Budd **single and dual wheels,** their construction and application under various conditions, with various tire sizes.

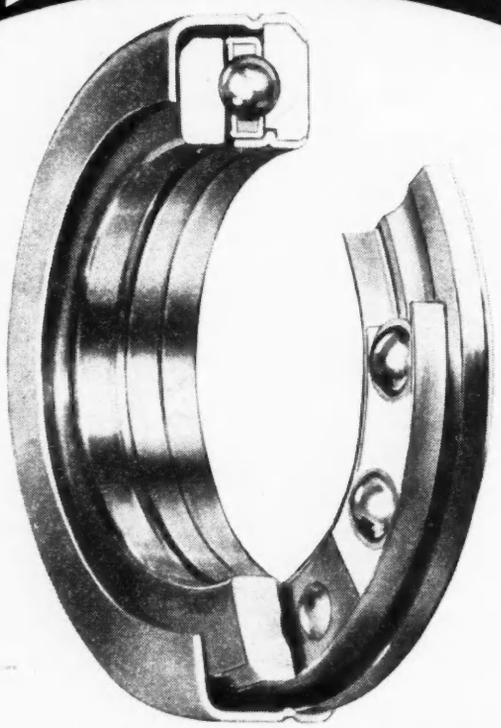
A bulletin on **Lewis Iron,** recently issued by Joseph T. Ryerson & Son, Inc., describes Lewis special staybolt iron, Lewis solid staybolts, the different types of Lewis engine bolt iron, and Lewis U. S. Navy chain iron. Applications, physical properties, sizes and shapes available, and other pertinent data are explained fully.*

Eaton plants and products are illustrated and described in a brochure issued by the Eaton Mfg. Co., Cleveland, Ohio.*

Republic Steel Corp., Cleveland, Ohio, has brought out a new two-color, 40-page catalog on Republic Double Strength Steel, a high tensile, low alloy product. The book should prove helpful to all designers, engineers and fabricators interested in the use of **high tensile, low alloy steel.***

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Sure, IT COSTS A LITTLE MORE...



BUT so does almost every part and material which goes into your automobile. There is practically nothing for which you couldn't substitute something a little cheaper . . . and not nearly so good.

The few cents extra which you lay out for the BCA Prelubricated Clutch Bearing actually buy a whole lot more in clutch operating value. Test it for yourself and you'll prove it for yourself.

BEARINGS COMPANY OF AMERICA : LANCASTER, PENNA.

BCA RADIAL • ANGULAR CONTACT • THRUST BALL BEARINGS

TNEC

(*Continued from page* 431)

compact management is demanded and developed and such management is given a free hand than where, due to an unduly complicated corporate structure, much red tape must be gone through before a development may be started or carried through.

The Ford company, it was stated, has no knowledge of any technological improvement that has resulted in the permanent displacement of workmen, in the sense that generally cooperative willing workmen cannot thereafter find employment. If there are isolated individuals seriously affected, it was said undoubtedly they should be and can be compensated without impeding for the use of civilization generally the great benefits of new developments. Mr. Ford declared that his company knows of no permanent displacement of workmen in the automobile industry as under normal conditions they are absorbed in jobs created by one or another technological change. Technological change was said to have increased occupational skills, increased individual earnings and improved the social economic status of workers, and to have made possible the use of men older and with less physical strength.

In general, Mr. Thomas attempted to sell the committee on what he called the differences in working conditions in organized and unorganized automobile plants, attributing the changes exclusively to the work of the union, took vigorous exception to many of the statements made earlier in the day by Mr. Ford, and charged that the failure of markets to expand in proportion to productive capacity is "one of the basic causes for unemployment, insecurity and economic hopelessness of our present time."

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

The Journal of Commerce index, without adjustment for seasonal variation, for the week ended April 13 stood unchanged at 93.8 per cent of the 1927-29 average, as compared with 94.2 a fortnight earlier and 80.0 a year ago. The Federal Reserve seasonally adjusted index of industrial production for March declined to 103 per cent of the 1923-25 average from 109 for February, as against 98 a year ago.

Improvement in retail trade was reported for the second week of April with sales totals ranging, according to Dun & Bradstreet estimates, from six to 11 per cent above levels a year ago, as against a corresponding margin of two to seven per cent in the preceding week. Department store sales during the four weeks ended April 6 fell two per cent below the comparable 1939 total, according to the Federal Reserve compilation, the unfavorable trend reflecting the influence of uneven dates of Easter.

Production of electricity by the light and power industry rose more than seasonally during the week ended April 13 and was 11.4 per cent greater than the corresponding output last year, as against a similar margin of 9.6 per cent in each week of the preceding fortnight.

Railway freight movement in the same period also registered a greater than seasonal gain. Car loadings numbered 618,810, as compared with 602,697 during the week before and 547,179 a year ago.

Bank debits to deposit accounts (except inter-bank items) in leading cities during the week ended April 10 were 10 per cent above the corresponding total last year.

Crude oil production during the week ended April 13 rose to an average of 3,853,800 barrels daily, exceeding by 303,800 barrels the required output as computed by the Bureau of Mines; the similar excess in the first week of the month was 195,000 barrels.

Average daily output of bituminous coal during the week ended April 6 was 1,420,000 tons, as compared with 1,412,000 tons for the week before; production a year ago, with a strike in effect, was negligible.

Engineering construction awards during the week ended April 18, according to *Engineering News-Record*, were one per cent below the corresponding total last year—a gain of 94 per cent in contracts for private work being offset by a decline of 22 per cent in those for public projects. General construction awards during March in the 37 states covered by reports of F. W. Dodge Corp. were nine per cent below the total a year ago.

Cotton-mill activity increased contra-seasonally in the week ended April 6. The New York *Times* adjusted index stood at 131.7 as compared with 128.1 for the week before and 121.4 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended April 12 rose to 84.5 per cent of the 1926 average from 83.7 for the preceding week, the year's low to date.

Excess reserves of the member banks of the Federal Reserve system rose $100,000,000 during the week ended April 17 to an estimated new peak of $6,050,000,000. Business loans of the reporting members a week earlier totaled $4,393,000,000, or $541,000,000 more than the corresponding amount last year.

40 YEARS AGO

A new lamp for motor vehicles burns kerosene oil and possesses unusual illuminating powers. It has a parabolic reflector whose edges extend well forward of the focal point, and the front consists of a moulded lens set in a door with polished flaring front. The back of the reflector carries a small lens of ruby glass, and the oil cup holds a supply for 24 hours.

From *The Horseless Age*, May, 1900.

"dag" beats heat!
MAINTENANCE DOLLAR
STRETCHED
1500%
The Forest City Foundries Company, Cleveland, have used until recently a mixture consisting of powdered graphite and kerosine on the conveyor chains of their vertical core ovens. With temperatures exceeding 450°F., application of this lubricant was required once every 3 or 4 days.
Introduction of "dag" colloidal graphite suspended in kerosine has cut this to one treatment every two months. And, as usual, there has been a reduction in flake off, carbon formation and wear.
We don't suggest that this result is typical of what happens in every case. It is another case history, however, from Industry showing the ability of "dag" colloidal graphite to step in where temperatures are beyond the limits of oil.
You or your oil supplier can add "dag" to your regular lubricants or to specially selected petroleum fluids. Write us for high temperature Bulletin 130.
ACHESON COLLOIDS CORP.
PORT HURON, MICHIGAN
dag
COLLOIDAL PRODUCTS
Coleman TOWER Core Oven
By The Foundry Equipment Co.,
Cleveland, Ohio

MEN . . . . . .

Fisher Body Division of General Motors Corp. has announced the following changes among its divisional resident managers: **Don R. Larkin**, manager of the Tarrytown (N. Y.) division, to be assistant manager of the Pontiac (Mich.) division; **Carl E. Hoehn**, manager of the Baltimore division, to be manager of the Tarrytown division; **Earl L. Klett**, manager of the Atlanta division, to be manager of the Baltimore division; **H. B. Lowendick**, manager of the Norwood (Ohio) division, to be manager of the Atlanta division, and **Carl W. Moyer**, assistant manager of the Norwood division, to be manager there.

Harold F. Olmsted, publicity director for Packard Motor Car Co. for the past 17 years, has resigned.

John J. Crowe, formerly manager of the Apparatus Research & Development Department of Air Reduction Co., has been appointed assistant to Herman Van Fleet, vice-president and operating manager. Mr. Crowe will direct the activities of the Apparatus Research & Development Department and will coordinate these activities with similar activities for Wilson Welder and Metals Co., Inc. In addition, he will handle apparatus patent matters for Mr. Van Fleet. **H. E. Landis, Jr.**, formerly assistant to Mr. Crowe, has been appointed manager of the Apparatus Research & Development Department. In another Airco change, **C. G. Andrew** has been appointed manager of gas plants.

I. L. Carron, body engineer, Dodge Div., Chrysler Corp., has been appointed sales manager of Prestole Devices. He was connected with Chrysler Corp. for the past 15 years.

Paul S. Lane, former research engineer of American Hammered Piston Ring Div., Koppers Co.. has recently been appointed research engineer of Muskegon Piston Ring Co.

H. H. Cohenour has resigned as advertising manager of the Sunnen Products Co. of St. Louis and has taken the position of advertising manager of the Buda Co., Harvey, Ill. **Russell R. Hughes**, who has been advertising manager of the Buda Company, has been made Midwest sales representative.

Appointment of **Ted H. Doescher**, of Chicago, as chief steward of the Indianapolis 500-mile race, has been announced by the Contest Board of the American Automobile Association. Mr.

The Modern Method Of
DRYING-BAKING

for the
Automotive Industry

In every industry where metal must be processed on large production schedules, you find progressive plants benefiting by the use of

ROSS OVENS and DRYERS
with oil or gas fired heating

In the three essential factors of Oven Construction, Method of Heating and Material Handling, Ross designed systems provide exceptional advantages. On a wide variety of automotive parts, Ross systems are providing cleaner products, more uniform temperatures and shorter baking or drying time.

Use our 20 years of experience to analyze your requirements; to assure correct oven construction, most economical fuel, a better product. No obligation.

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Tower Dryers
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Batch Type Ovens
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Continuous Ovens
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408 Empire Bldg. PITTSBURGH, PA.
ROSS ENGINEERING OF CANADA, LIMITED, Dominion Square Building, Montreal

CALENDAR

Conventions and Meetings

American Foundrymen's Association, Convention, Chicago .....May 6-10
SAE National Production Meeting, Hartford, Conn. .....May 7-8
American Iron & Steel Institute, Annual Meeting, New York.....May 23
Automobile Manufacturers Association, Annual Meeting, Detroit.....June 6
SAE Summer Meeting, White Sulphur Springs, W. Va. .....June 9-14
Automotive Engine Rebuilders Association, Convention, St. Louis, Mo., June 10-13
American Society for Testing Materials, Annual Convention, Atlantic City, N. J. .....June 24-28
National Industrial Advertisers Association, Annual Meeting, Detroit, Sept. 18-20
American Society for Metals, Annual Meeting, Cleveland, Ohio....Oct. 21-25
American Welding Society, Annual Meeting, Cleveland .....Oct. 20-25
Aeronautical Chamber of Commerce of America, Inc., Annual Meeting, New York .....Dec. 5
National Association of Manufacturers, Annual Meeting, New York..Dec. 9-13
National Automobile Dealers Association, Convention, Pittsburgh, Pa. Jan. 20-23, 1941

Shows at Home and Abroad

National Automobile Show, Grand Central Palace, New York.....Oct. 12-19
National Metal Congress & Exposition, Cleveland, O. .....Oct. 21-25
Automotive Service Industries Show, Chicago .....Dec. 9-14
Pittsburgh Automobile Show ....Oct. 19-26

Crude Turpentine As a Motor Fuel

That crude turpentine can be utilized successfully as a motor fuel is said to have been demonstrated in Sweden following experiments conducted by a local motor expert under the sponsorship of the Hanomag Automobile Co. according to a report from Commercial Attache George C. Howard, Stockholm.

Published reports state that a copper plate, having a hole of smaller diameter than the cylinder, is placed between the cylinder head and engine block Heat retained by the copper aids in vaporizing the turpentine. Thus far the method has been developed only for the use of engine having overhead valves.

Doescher succeeds **Charles C. Merz**, who on Jan. 1 of this year retired as chief steward to take over duties as assistant to the general manager of the Indianapolis Motor Speedway.

Norman L. Deuble is now associated with the Copperweld Steel Co. at Warren, Ohio, as assistant to the vice-president. Mr. Deuble was previously with the Republic Steel Corp. and had been associated with the Central Alloy Co. and the United Alloy Steel Co.

Pierre Schon, affiliated with the Yellow Truck & Coach Co. for the past 25 years, has resigned to take over the General Motors Truck dealership at Jacksonville, Fla.

Edward F. Roberts, former vice-president of the Packard Motor Car Co., has been elected a director of the L. A. Young Spring & Wire Co.

A. L. Struble has been appointed general sales manager of the Fruehauf Trailer Co. Mr. Struble, who has been assistant sales manager of the Fruehauf Company for the past year, has already assumed his new duties, with headquarters at the factory in Detroit.

R. A. Hutchinson has been elected to the newly created post of vice-president and general manager of the Studebaker Export Corp.

Wendell H. Welch, formerly assistant director of service, has been appointed sales promotion manager of the Export Division of Chrysler Corp., succeeding E. E. Pratt, who has resigned.

Lee M. Clegg, senior vice-president, Thompson Products, Inc., has been elected executive vice-president. He will have charge of all plant operations as well as customer relations.

Clarance Hatch, Jr., has been named vice-president of D. P. Brother and Co., Detroit advertising agency. Mr. Hatch has served as the Oldsmobile account executive for the past five years and in his new office will continue to head the agency's Oldsmobile group.

Ourselves & Government

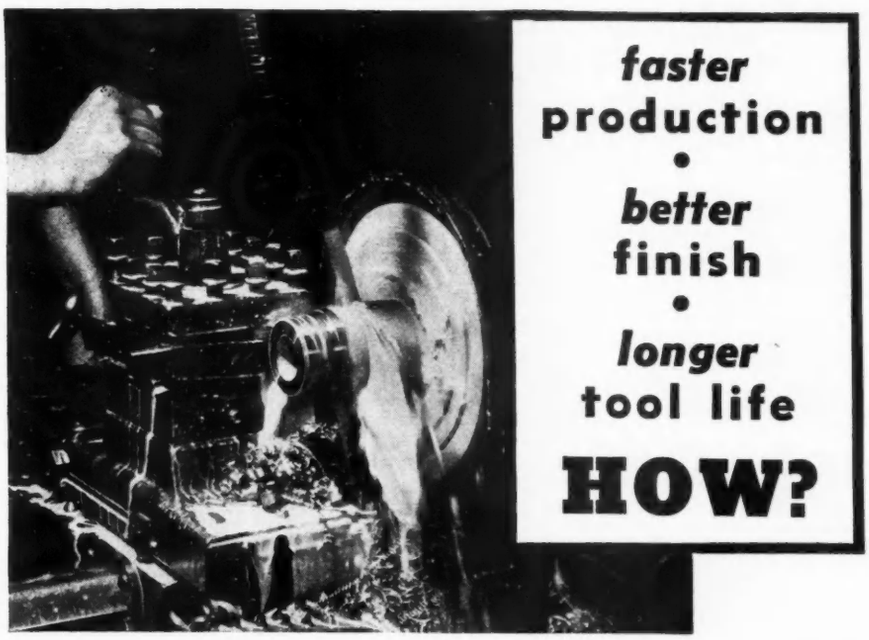
A Check List of Federal Action Corrected to Apr. 25

FEDERAL TRADE COMMISSION

F.O.B. PRICE CASE—Trial examiner's report next development expected in the Ford case. Testimony closed in GM case, after respondent waived oral argument. Trial examiner's report, commission brief and respondent's reply brief all filed. Mailed to respondents on April 18 was FTC supplemental brief.

FAIR TRADE PRACTICE RULES—NADA granted extension of time to file brief in opposition to FTC's proposed rules. Other statements, also in opposition, have been filed.

VS. GENERAL MOTORS—Charge that dealers are required to handle GM parts exclusively. Testimony concluded. Examiner's report awaited.



If these are problems that concern you, why not let our lubrication engineers help you solve them with the right cutting fluid? They have done that for others. They can do it for you!

One prominent screw manufacturer*, for instance, was thus able to step-up production 25%, lengthen tool life and turn out better finished work than he was able to do previously.

Cities Service Metal Cutting lubricants are made to meet the exacting needs of modern industry by specialists conversant with every phase of metal cutting lubrication. Let us get acquainted for mutual profit.

Copies of our booklet on "Metal Cutting Lubrication" are still available to users of cutting fluids. Write for your copy—today—before the supply is exhausted.

* *Name furnished on request.*

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City..... State.....

Form National Automobile Salesmen's Association

Formation of the National Automobile Salesmen's Association was announced in Detroit April 13. Its aims, according to Richard Giddey, the treasurer, are to better conditions for the automobile salesman in the industry, improve his welfare and raise his income through higher commissions. The national association is an outgrowth of the Detroit Automobile Salesmen's Association, which was organized April 6, 1937, and now has a membership of several hundred salesmen in the Metropolitan Detroit area.

William J. Chalker, a salesman with Caldwell Sales & Service, Inc., Pontiac dealer in Detroit, is president of the new national association. F. Raymond Lewis, the national secretary, like Chalker, is a Pontiac salesman with Caldwell Sales & Service. Giddey was an automobile salesman for 17 years before he took over the organization of the Detroit and national associations.

Injectors

(*Continued from page* 13)

start carburetor manufacture. In reply to this the Solex Company, which practically dominates the French market and has important interests in Germany, announced that it would enter the injector field, which is almost entirely held by Bosch. The outcome was a signed agreement between Solex and Bosch, in which the former undertook not to manufacture injectors and the latter agreed to keep out of the carburetor field.

The German authorities, finding that they were dependent on foreign countries (Solex, French, and Stromberg, American) for their carburetor technique, instructed Bosch to push injector development for aero engines. After working on the problem for five years, injectors have been perfected, but, it is claimed, they offer no technical advantages over the carburetor and their servicing is much more difficult. The injector prevents freezing; but with the Hispano-Suiza-Solex device with the compressor blowing on the carburetor, this difficulty is effectively overcome. The main practical disadvantage of the injector is that it loads up the engine with gas when on a steep dive, causing spluttering when pulling out. French and English pilots have frequently claimed to have brought down German planes which were emitting black smoke, when that smoke was only caused by the injector pumping an excess of gasoline into the cylinders.

French carburetor experts deny that Germany has been forced to the use of low-grade gasoline on airplane engines and, at a time when production is all important, they oppose any stampede to the injector merely because it is used by Germany.

Compression • Extension • Torsion Springtime

WHEN the time comes for you to buy springs, give thought to the quality and service you can get from Accurate. Whether the spring you need is the tiniest hair-like coil or a stout steel brute for slam-bang service, you'll find that Accurate controls and checks quality to the "nth" degree. Accurate builds dependability into its products to help you build it into yours. Accurate takes more than ordinary measures to meet delivery dates to help you meet yours. This care is building business for Accurate. It will help do the same for you. Let Accurate meet your next spring requirements — write today.

Accurate Springs

Write today for the new Accurate Handbook — FREE

ACCURATE SPRING MANUFACTURING CO.

3811 West Lake Street • Chicago, Illinois

Two Million Carburetors a Year

(*Continued from page* 413)

An examination of some cases of quality control may throw some further light on the production problems encountered in work of this character. The metering rod jet has an interior orifice which is held to plus or minus 0.00025 in. on the diameter while the length of the orifice is held within plus or minus 0.0025 in. The slip nozzle, a tubular brass piece, has an orifice 0.125 in. in diameter at its tip held within plus or minus 0.0005 in. in reaming. The idle orifice tube has a necked end section in which the drilled hole is specified 0.0276 plus or minus 0.0005 in. The main metering jet is checked by flowing, the requirement for one model being a delivery of 254 to 258 cc. of liquid per min., with jet submerged.

All springs are of music wire and are checked 100 per cent with a simple gage in which the spring must compress to a gage height under a standard weight. An example of a typical specification is as follows:

a. Compress to 7/16 plus or minus 1/32 in. with load of 8.45 oz.

b. Compress to 5/16 plus or minus 1/32 in. with load of 11.9 oz.

c. Solid height not to exceed 15.64 in.

MEN and MACHINES

(*Continued from page* 425)

in.; reach 15 in:; and overall height 113 in. Table to floor is 40 in. Operating speeds are 83 in. per min. power stroke, 157 in. per min. return stroke. The hydraulic power unit is driven by a 10-hp. motor.

HARDINGE BROS., INC., Elmira, N. Y., has developed a new machine, the TM precision preloaded ball bearing tool room miller, which replaces its model BB5. The TM model is the result of careful consideration given to the requirements of the tool room miller. In it, a longer vertical travel is incorporated to allow use of the index head in the vertical position. The horizontal spindle nose and the spindle nose of the index head are both the same and of the threaded type, thus allowing interchangeability of chucks and other spindle nose fixtures. Collets are also interchangeable between the horizontal spindle and the index head spindle. The horizontal spindle has been extended over the table to permit small end mills to get to the work without the use of overhung adapters.

Either of two high spindle speed ranges are provided, namely, from 110 to 1850 r.p.m., or 110 to 2775 r.p.m In both cases, the slow, low spindle speed is retained for use when required. The machine is anti-friction bearing equipped throughout. The overarm has anti-friction bearings to eliminate any possibility of freezing at high spindle speeds.

The column has been increased for heavier cuts, and greater rigidity. The machine is easily operated by the use of one lever only, which operates the electrical control mounted on a panel inside the miller column for accessibility when desired. A steel pedestal driving unit completely incloses the drive, in which no loose pulleys, gears or clutches are employed.

Bevel gears and transverse feed nut are completely enclosed in the box type knee to prevent the entrance of foreign matter. All the slides are taper gibbed in keeping with modern machine design. Large dials are provided graduated in thousandths of an inch for ease in reading and operation.

This machine is offered with or without power feed for longitudinal travel of the table. The power feed is of the vee-belt driven type. Thirty-two feeds are available ranging from approximately ⅛ in. to 13 in. per minute.

GENERAL ELECTRIC CO. has announced a new inductor type dynamometer for engine testing. This machine, less than half as large as the direct-current machine, is rated 600 hp., as compared with a 300-hp. rating for the d-c dynamometer.

Advantages claimed for the new dynamometer are accurate torque indication at low cost, low maintenance because of simplified construction, compact design, and ease of operation. Torque and speed are controlled by a simple rheostat.

Control for the inductor dynamometer involves a main field rheostat and a vernier rheostat for the control of torque and speed. They regulate the current to the field coil in the same way that it is regulated in the case of a d-c machine. There are also a push-button-operated line contactor for the

Index Turns Upward Again

The National Machine Tool Builders' Association reports that March operating activity of the machine tool industry stood at 93.4 per cent of capacity compared to 92.9 per cent in February, and 93.3 per cent for January, 1940.

STEEL *for the Cars and Trucks of Tomorrow*

LONG BEFORE America's automobiles roll off the assembly line, long before they meet the public in the showroom or on the highway, many of the steels for their crankshafts, axles, camshafts, connecting rods, and gears are in production at Wisconsin Steel. Here the mill and the laboratory work together with one aim: the *right* steel for the *specified* job.

Supplying high quality steels to automotive manufacturers is a service we hold in deep regard. The quality of these steels is assured by careful selection of materials, precision manufacture, and rigid inspection. Write or phone us about your steel problems. We are well equipped to make a wide variety of alloy and carbon steels, exactly to your specifications.

WISCONSIN STEEL COMPANY
General Offices:
180 North Michigan Avenue, Chicago, Illinois
Affiliate of International Harvester Company

WISCONSIN STEEL

d-c supply, and an ammeter and voltmeter for the field circuit. If the prime mover is an internal-combustion engine, interlocks also are provided to cut off ignition under the conditions of too high a temperature due to failure of water supply, or failure of excitation.

Federal Products Corp., Providence, R. I., has made a number of improvements in its model N comparator. The new model is designated as model NB-60. The base of the gage has been redesigned to make it more modern and efficient and is now supported on three feet instead of four, so that a positive footing is assured wherever the gage may be placed.

The supporting column has been made heavier and the regular supporting bracket now holds the indicator by the back instead of by the stem. All indicators on this particular model heretofore have been held by the stem. Federal now recommends that indicators are not to be held by the stem because of the liability of binding the rack spindle.

Holes are provided in the base through which an angle attachment can be fitted for holding cylindrical work or to act as a stop for work placed on the platen. An attachment can be furnished, at additional charge, to take the place of the regular supporting bracket. It provides a fine setting for the indicator by means of a thumbscrew located just in front of the post. This bracket permits adjustment of ten to twenty thousandths.

The manufacturer states that this instrument is practical for setting and checking other gages to be used in production inspection. It is used, too, in production and inspection and is said to be a very quick and accurate gage for checking pistons, piston pins, valve stems, bolts, flat stock, bushings, reamers, drills, arbors, taps dies, gear blanks and hundreds of other parts.—H. E. B., Jr.

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The series of lapping operations performed as a matter of course in the Strom plant give Strom Steel Balls a degree of surface smoothness and sphericity that has always been unequalled in any other regular grade of ball. Only through such unique lapping practice can extreme precision be obtained.

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Publications Available

"The ABC of Spray Painting Equipment" is a new handbook published by the De-Vilbiss Co. The subjects treated are, the paint spray gun—its troubles, remedies and accessories; material containers; hose and hose connections; air transformers and condensers; and air compressing outfits.*

"Wilson Arc Welding Electrodes," an illustrated 24-page booklet issued by the Wilson Welder and Metals Co., Inc., New York, reviews the general description, application, procedure for use, and physical properties of Wilson electrodes for numerous and varied welding purposes. A final section of the booklet is devoted to welding symbols and instructions for their use.*

The Acme Steel Co., Chicago, has issued a leaflet which describes various applications for its **Steelstrap** packaging equipment.*

A new illustrated catalog covering **standard tools for ram type turret lathes** has been issued by the Gisholt Machine Co., Madison, Wis.*

Jessop Steel Co., Washington, Pa., has prepared a pamphlet which describes the characteristics of "Truform," an oil hardening non-shrinkable **alloy steel.***

"Lightnin" **laboratory mixers** are the subject of catalog B-67 brought out by the Mixing Equipment Co., Inc., Rochester, N. Y.*

"Some Industrial Applications of Current 16-mm Sound Motion Picture Equipment" is the title of an article by W. H. Offenhauser, Jr., and F. H. Hargrove which was published in the Journal of the Society of Motion Picture Engineers, February, 1940, and is now available in pamphlet form. Messrs. Offenhauser and Hargrove are associated with the Berndt-Maurer Corp., manufacturer of sound film equipment. This company's products are described in two new catalogs, the "B-M Sound-Pro Camera" and the "B-M 16 mm Sound Recording System."*

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Perfect Circle Re-Elects Officers and Directors

All officers and directors of the Perfect Circle Co. were re-elected for the year 1940 at the annual stockholders meeting held at Hagerstown, Ind., April 15.

Officers for 1940 are Lothair Teetor, president and general manager; Ralph R. Teetor, vice-president; Leslie B. Davis, Secretary-treasurer; C. Ray Teetor, assistant secretary-treasurer. Directors re-elected are Lothair Teetor, Ralph R. Teetor, Don H. Teetor, Dan C. Teetor, Herman Teetor, Macy O. Teetor, George H. Keagy, W. Blair Hartley and Wallace M. Harkrader.

Twenty Years of Tractor Tests

(*Continued from page* 415)

the holder the right to copies of all reports issued in the course of one year cost one dollar.

When a tractor manufacturer wishes to have a new model subjected to official tests, he writes for application forms to the Agricultural Engineering Department of the University of Nebraska at Lincoln. These forms, which call for detailed specifications of the tractor to be tested, are filled out and returned with a request for the assignment of a testing date, and with a check for $500, the amount of the test fee. The actual date for test is set only after the tractor has arrived in Lincoln and is, of course, also influenced by weather conditions. In addition to the official test, which is run in accordance with fixed regulations, the manufacturer may, later on, have carried out any desired experimental work, for which he is charged on an hourly basis, and the results of such experimental tests are, of course, not included in the official report.

A representative of the manufacturer is present throughout the tests. Before any tests are made, the oil is drained from the crankcase and replaced with new oil, of a brand selected by the manufacturer's representative from those available in Nebraska, and of the viscosity specified in the application for test. It is purchased by the Tractor Testing Section in sealed containers. Its weight per gallon at 60 deg. Fahr. is determined. The fuel used is the lowest grade recommended by the manufacturer for the particular tractor model. For instance, if the manufacturer in his application for test states that the tractor can be operated on gasoline, kerosene and distillate, the last mentioned is used in the test. The gasoline used is the lowest commercial grade available, and premium-grade gasoline is used only when the manufacturer states that it is essential to the successful operation of the engine. Fuels and lubricants are supplied by the University and charged to the manufacturer at current prices.

As already mentioned, the first belt test is made with the carburetor set for absolute maximum power. If the manufacturer wishes to use a leaner setting, a series of trial runs of 20 to 30 minutes' duration are made with different settings, and his representative is permitted to choose an "operating setting" from these. All remaining tests, with the exception of the 100-percent-maximum drawbar test in rated gear, are made with this setting.

At the conclusion of the belt tests the friction horsepower and the compression pressure at rated engine speed are determined, if possible. These results are not included in the report of the test, but serve to check the condition of the engine at the beginning of the drawbar tests.

Drawbar tests are made on an outside track, the tractor hauling a drawbar load through a so-called traction dynamometer, consisting of a cylinder and piston, with the space between cylinder head and piston filled with oil. A tube leads from the cylinder to a recording pressure gage. The pressure on the oil is, of course, directly proportional to the drawbar pull. Drawbar tests are made under two headings, Test G, operating maximum, and Test H, rated-load drawbar test. The object of the former is to determine the maximum horsepower the tractor will develop in each forward gear with the carburetor adjusted at the operating setting and the engine running at rated speed. The rated-load drawbar test, which extends over 10 hours, as nearly continuously as possible, has for its objects to determine whether the tractor can pull its rated load continuously and to secure a record of fuel consumption in drawbar work.

Once each hour during the rated drawbar test determinations of drawbar pull and tractor speed are made, the latter by observing the time it takes to cover a distance of 500 ft. At the same time the number of drive-wheel

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revolutions over the same course, and the temperatures of the air and cooling medium are noted. From the dynamometer record and the observed values the drawbar pull in pounds, the speed in feet per minute and miles per hour, the drawbar horsepower, the engine speed in r.p.m., and the wheel slippage in per cent are calculated.

The first drawbar tests are maximum horsepower runs at two carburetor settings, "operating" and "100 per cent." The "100 per cent" maximum test is made in one gear only, that designated by the manufacturer as most suitable for plowing or ordinary farm work. The observed 100 per cent maximum drawbar horsepower corrected to standard atmospheric conditions and multiplied by 0.75, is the "calculated" drawbar horsepower rating given in the report.

Operating maximum drawbar tests are made in all forward gears, use being made of the "operating" carburetor setting. The last run made on the drawbar is the rated-load test. It is continued for 10 hours, under constant load. The time and reason for each stop, as well as any adjustments and repairs made on the tractor during this run are recorded.

At the conclusion of the rated-load drawbar test the oil is drained from the crankcase and weighed, and its specific gravity at 60 deg. Fahr, is determined. A record is kept of all oil added or drained, and the test report shows the number of gallons of new oil put in and the gallons of used oil drained.

After the crankcase has been drained the tractor is inspected. Such items of the specifications as clearance volume, valve and port dimensions, bore and stroke, and transmission, final drive and belt-pulley reduction ratios, and the condition of such parts as valve heads and seats, spark plugs, magneto or distributor breaker points, and fuel, oil and water connections are checked.

During the drawbar tests, or on their completion, the tractor is driven to a farm scale on the Agricultural College campus and weighed, and the weight of the tractor with the operator and a tankful of fuel is entered in the report. Upon completion of all tests the tractor is released to the manufacturer's representative.

These tractor tests conducted by the University of Nebraska under legislative authority have no parallel in any part of the world. The principal object of the original Nebraska law was to give practical aid to buyers in chosing tractors for use on their farms. Not only has it served this purpose satisfactorily, but it also has been a help to manufacturers in further developing their designs. That no other state has followed Nebraska in adopting similar legislation may be taken as an acknowledgment of the thoroughness with which the Nebraska Board of Tractor Test Engineers has done its work. Results of the Nebraska tests are available to farmers everywhere; if they contained the information the tractor buyer desired, there was no need for similar tests elsewhere, whereas if they had failed to fully meet requirements there is no doubt that some other legislative body would have attempted to improve upon the Nebraska law and on the test procedure carried out under its authority.

Today, of course, there is no longer the same need to protect the tractor buyer against unwarranted claims of manufacturers that there was in 1919, as the tractor industry has become stabilized and its members have reputations to protect. But the official tests still serve a useful purpose in that they give the tractor buyer definite information regarding the power and economy of the various tractors offered to him, and also assurance that the tractors possess at least the necessary stamina to pass the tests successfully. They are of value also to the manufacturer, in that they furnish him accurate information on the standing of his product relative to that of his competitors, with respect to power and fuel efficiency.

Nebraska's Board of Tractor Test Engineers has three members, E. E. Brackett, C. W. Smith, and L. W. Hurlburt. Carlton L. Zink is engineer in charge of tests, and C. F. Adams is assistant test engineer.

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